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Mission Planning and Analysis Division

June 1979

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National Aeronautics and Space Administration

Lyndon B. Johnson Space Center

Houston, Texas

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(Supersedes JSC-13968)

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SHUTTLE PROGRAM

STS-7 CONCEPTUAL FLIGHT PROFILE

IUS/TDRS-A

By Flight Planning Branch

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June 1979

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1.0 INTRODUCTION AND SUMMARY

The Space Transportation System (STS) Flight Assignment Manifest (ref. 1) has scheduled a Tracking and Data Relay Satellite System (TDRSS) spacecraft (TDRS-A) for a February 1981 launch on STS Flight 7.

This flight design document has been developed by the Mission Planning and Analysis Division (MPAD) in support of the TDRS-A Cargo Integration Review scheduled for June 1979.

This document (Flight 7 Conceptual Flight Profile) contains the preliminary flight profile that conceptually implements the flight requirements and constraints levied by the STS, inertial upper stage (IUS), and the TDRS spacecraft.

The general content of this document consists of the integrated major flight design guidelines and requirements used in the development of the flight profile together with a flight sequence of events and time line that describe the profile and reflect implementation of the integrated set of requirements. Questions concerning this document should be addressed to Jerome Bell/Flight Planning Branch.

2.0 Acronyms

AFSCF	Air Force satellite control facility
AFO	abort from orbit
AOA	abort once around
AOS	acquisition of signal
APU	auxiliary power units
ASE	airborne support equipment
ATCS	active thermal control system
CFP	conceptual flight profile
c.g.	center of gravity
CIR	cargo integration review
Δt	time increment
ΔV	incremental velocity
DOD	Department of Defense
EAFB	Edwards Air Force Base
EDT	eastern daylight time
EPDC	electrical power distribution and control
ET	external tank
EVA	extravehicular activity
FCP	fuel cell power plant
fps	feet per second
FTR	flight test requirements
FWD	foward
GET	ground elapsed time
GMT	Greenwich mean time
GPC	general purpose computer

GSTDN	ground spaceflight tracking and data network
ha	apogee altitude
hp	perigee altitude
IMU	inertial measurement unit
IUS	inertial upper stage
JSC	Johnson Space Center
KSC	Kennedy Space Center
LH	local horizontal
LOPT	landing opportunity
LOS	loss of signal
LV	local vertical
LVLH	local vertical/local horizontal
MECO	main engine cutoff
MPAD	Mission Planning and Analysis Division
MPS	main propulsion subsystem
NPC	nonpropulsive consumables
OA	Orbiter after
OMS	orbital maneuvering system
OMS-1	first OMS maneuver
OMS-2	second OMS maneuver
OP	Orbiter prior
PET	phase elapsed time
PI	payload integrator
PIP	payload integration plan
PLBD	payload bay doors
PROP	propellant

psf	pounds per square foot
PTC	passive thermal control
q_{max}	maximum dynamic pressure
RCS	reaction control system (Primary)
RF	radio frequency
RMS	remote manipulator system
RTLS	return-to-launch site
RTS	remote tracking stations
SPIDPO	Shuttle payload integration and development program office
SRB	solid rocket booster
SRM-1	IUS stage-1 solid rocket motor
SRM-2	IUS stage-2 solid rocket motor
SSME	Space Shuttle main engine
ST	star tracker
STS	space transportation system
SV	Shuttle vehicle
TBD	to be determined
TCS	thermal control system
TDRS	tracking and data relay satellite
TDRS-A	first TDRS spacecraft
TDRSS	tracking and data relay satellite system
TVCS	thrust vector control system
VRCS	vernier reaction control system
WTR	western test range
-ZLV	payload-bay-to-Earth attitude

3.0 GUIDELINES AND GROUNDRULES

3.1 GENERAL FLIGHT REQUIREMENTS

a. The launch date is February 27, 1981.

b. Nominal end-of-mission shall be planned for 2 days.

c. The nominal post-Orbiter maneuvering system-2 (OMS-2) parking orbit is 150 n. mi. circular.

d. At the time of deployment, the minimum parking orbit shall be the equivalent of a 150 n. mi. circular orbit.

e. The nominal parking orbit inclination is 28.48 degrees.

f. The launch and landing site is Kennedy Space Center (KSC)

g. The payload complement consists of a tracking and data relay satellite (TDRS-A) spacecraft integrated on a Department of Defense (DOD) 2-stage inertial upper stage (IUS), the IUS airborne support equipment (ASE), and the necessary space transportation system (STS) cargo-chargeable equipment required to interface the IUS vehicle with the Orbiter.

h. The crew size is four.

i. Orbiter vehicle 102 configuration per reference 2 will be used.

j. The capability shall be provided to allow a return from orbit without having to deploy the IUS/TDRS.

k. Launch window shall be selected to prevent nominal end-of-mission or abort landings from occurring prior to sunrise or later than sunset.

l. Return-to-launch site (RTLS) and abort-once-around (AOA) landings will be planned to be at KSC.

m. Provide the consumables loading to allow a landing within 7 hours GET for an abort from orbit (AFO).

n. A backup landing opportunity will be provided one revolution after nominal landing.

o. The maximum space Shuttle main engine (SSME) thrust for nominal ascent is 100 percent; for aborts, the maximum thrust is 109 percent.

p. Liftoff, end-of-mission, and abort landing payload weights are per the Payload Data Annex to the TDRS Payload Integration Plan (PIP).

q. The payload bay doors (PLBD) are to be opened as soon as operationally convenient after OMS-2, however keeping the PLBD closed for up to 3 hours after launch shall not preclude continuation of the mission.

r. The TDRS command and telemetry links must be checked out onorbit prior to deployment. The nominal path will be: Ground spaceflight tracking and data network (GSTDN), Orbiter, Payload Interrogator, and TDRS.

s. One opportunity shall be provided for a direct TDRS to GSTDN radio frequency (RF) check prior to deployment. This is a contingency operation.

t. When the PLBD are open, the Orbiter will fly a payload bay to Earth (-ZLV) attitude except during the following activities:

(1) All Orbiter inertial measurement unit (IMU) alinements

(2) TDRS/STDN direct RF check

(3) IUS attitude initialization

(4) IUS/TDRS deployment operation

(5) Preentry thermal conditioning, as required

u. The nominal geosynchronous placement longitude is 53 degrees west.

v. The maximum payload allowance will be based on two sigma flight performance reserve loading for AOA.

w. There will be four potable water tanks available for cooling using the flash evaporator. Also, one additional waste water tank can be used for additional cooling during aborts and contingencies. The potable water tanks will be 95 percent full for normal entry.

x. For nonpropulsive consumables budgeting, the following contingencies will be considered.

(1) A 24-hour hold without reservice

(2) The worst case of the following:

(a) Cabin puncture

(b) One extravehicular activity (EVA)

(c) Last deorbit opportunity on mission extension day

(d) One cabin repressurization

(e) Deorbit one orbit late

y. Computation and communications required to develop and transmit a ground navigation state vector and Orbiter maneuver include the following:

(1) Tracking passes over at least three stations distributed during one complete revolution are required to acquire enough data for computing an accurate ground navigation state vector.

(2) Two additional tracking passes are required to provide backup and maintain navigation accuracy in the event of tracking station loss during one of the passes in (1) above. These backup passes may be located either before, after, or before and after the tracking interval in (1) above.

(3) All station passes should be above 3 degree ground station elevation.

(4) Fifteen minutes are required for ground computation of state vector.

(5) Twenty minutes are to be allocated for computation of the Orbiter maneuver and uplink pads given the above state vector as input.

(6) One primary and one backup station pass are required for uplinking the state vector and/or maneuver data.

z. When possible, deorbit should be executed on a path that allows tracking by a station between deorbit cutoff and entry interface. This station pass must be at a minimum of 14 degree elevation.

aa. Propellant loading for attitude control shall be planned on the basis of using primary RCS only. The resulting propellant loading will be needed in the event of a failure of the vernier RCS.

bb. The IUS flight operations requirements and constraints are as presented to the Shuttle Payload Integration and Development Program Office (SPIDPO) at the Johnson Space Center (JSC) 17 April 1979 and documented in a letter from Col. Shaffer, IUS Program Director, to G. Lunney, Manager, SPIDPO.

cc. The TDRS flight requirements and constraints are as defined in the TDRS PIP, 19 April 1979.

dd. The detailed TDRS/IUS data required for flight design implementation are as defined in the TDRS/IUS PIP annexes.

ee. The Orbiter separation sequence will be designed in accordance with the criteria and philosophy contained in formal briefings to STS management (references 3 and 4).

ff. 900-n. mi. crossrange operational capability for landing will be assumed.

gg. The solid rocket booster (SRB) configuration is the TC-121-78 and uses the Western Test Range (WTR) burn rate.

hh. There is no SRB ignition delay.

ii. SSME propellant line screens are assumed to be removed for this flight.

jj. The abort decision lag time is zero.

4.0 FLIGHT DESCRIPTION

This section describes the nominal mission profile. An integrated flight activities time line is found in figure 1, and the integrated major events table is shown in table I.

Orbiter Earth groundtracks for the entire flight are shown in figure 2, and the Orbiter attitude time line is presented in table II. Table III gives the separation maneuver summary of events while figure 3 depicts the composite launch window. The Orbiter weight summary utilizing data from reference 1 are found in table IV. Figure 4 is a diagram depicting the Orbiter, IUS, and TDRS coordinate systems.

The ground spacecraft tracking and data network (GSTDN), for Orbiter and TDRS support and the Department of Defense's AFSCF remote tracking stations (RTS), for IUS support, will be used for this flight. The assumed communications network is found in table V. Figure 5 shows the IUS and TDRS-A (OMNI) pattern. Table VI presents data on the GSTDN and RTS coverage. Figure 6 shows onorbit pictorial summaries and table VII shows Flight 7 communication and navigation opportunities. Figure 7 depicts relative motion between the Orbiter and IUS-TDRS-A postseparation. Table VIII shows sunrise/sunset data. Table IX and figure 8 present the nonpropulsive consumables loading data. Table X gives data on OMS and RCS budgets.

4.1 LAUNCH WINDOW

The STS-7 launch window for a February 27, 1981 launch date opens at 19:34:35 GMT and closes at 20:16:33 GMT. Nominal lift-off time for this flight is planned for the opening of the launch window, 19:35:00 GMT. The 42-minute launch window duration results solely from the TDRS-A requirement to achieve a right ascension of the ascending node of the placement orbit between 275 degrees and 290 degrees. It is compatible with descending node transfer orbit injection opportunities on the first day and ascending node transfer orbit injection opportunities on the second day that achieve longitude placement within a 53° W to 99° W range at geosynchronous orbit arrival. The latest launch can occur and still maintain the daylight landing constraint is 20:50:00 GMT regardless of TDRS-A requirements. An integrated launch window is summarized in figure 3. This figure shows the available launch window for all components that define the composite launch window.

4.2 FLIGHT PROFILE SUMMARY

4.2.1 Ascent to OMS-2

The Shuttle will be launched from KSC on a 90.0-degree launch azimuth on February 27, 1981. Launch time is 19:35:00 GMT (14:35:00 EST, February 27, 1981, KSC local time). Nominal main engine cutoff (MECO) occurs 8 minutes 10.00 seconds after launch, inserting the Orbiter into a 78.0- by [illegible]12.0-n. mi. orbit. The Orbiter is in a payload-bay-to-Earth attitude.

The external tank (ET) is jettisoned and 120.0 seconds after MECO an OMS-1 burn is performed raising the apogee of the Orbiter orbit to 150.0 n. mi. and perigee to 56.0 n. mi. This is a 211.0 fps maneuver with a burn time of approximately 131.0 seconds.

An OMS-2 maneuver is performed at apogee of the 150.0- by - 56.0-n. mi. orbit about 35.5 minutes after the OMS-1 burn (45:43.0 GET). This 169.0 fps maneuver, of approximately 105.0 seconds duration, circularizes the orbit at 150.0 n. mi.

4.2.2 OMS-2 to Deployment

The PLBD are opened 35 minutes after completion of the OMS-2 maneuver at 1 hour 20 minutes GET. To fulfill payload thermal requirements and constraints, the Orbiter maintains a payload-bay-to-Earth (-ZLV) attitude except during those operations requiring special attitudes; e.g., star scan maneuvers, RF communications, IMU alinements, and deployment operations. These activities are either in darkness passes or in the shadow of the Orbiter.

At 1 hour 55 minutes GET, an IMU alinement is performed to support normal Orbiter procedures. Following the IMU alinement, a block of time from 2 hours 25 minutes to 6 hours 15 minutes GET is devoted to early Orbiter postinsertion operations. The first activities in this time period are an early IUS health check followed by an early TDRS-A payload interrogator (PI) command link check over the MIL tracking station. The Orbiter then performs a star scan maneuver to support the IUS attitude initialization test. These data are downlinked, and a state vector is uplinked along with the postinsertion trim maneuvers. These trim maneuvers, performed to arrest insertion dispersions and trim the Orbiter into the nominal deployment orbit, are executed between 4 hours 57 minutes and 6 hours 15 minutes GET. Although it is planned to execute these as RCS maneuvers in a -ZLV attitude, the precise method of execution will be developed as part of the flight control and crew procedures development activities. The time line and performance budgets presented in this CFP are based on a maximum of two RCS trim maneuvers, budgeted up to 15 fps, executed within one revolution.

Operations that support deployment begin at 6 hours 23 minutes GET and continue through deployment. Initially, the Orbiter performs an IMU alinement to support the final IUS attitude initialization maneuvers which begin at 7 hours 53 minutes GET. At 8 hours 37 minutes GET, the Orbiter is over the IOS track station. During this pass the predeployment checkout is performed along with an uplink of the Orbiter state vector and an update to the deployment time and attitude. The HAW pass will serve as a backup for these activities.

The Orbiter then performs an attitude maneuvering sequence to achieve the deployment attitude. Since these maneuvers occur in daylight, the sequence is done in such a manner that the Orbiter constantly shades the P/L from the Sun and ends with the Orbiter in the inertial deployment attitude. These maneuvers begin at 8 hours 53 minutes GET. After the Orbiter is in the deployment attitude, the tilt table is elevated to 29 degrees. The predeployment TDRS-A checkout, including activation and RF checks through the PI of the TDRS-A transmitter, occurs over the HAW tracking station. This is the last RTS

site available prior to the nominal deployment opportunity. The AGO GSTDN tracking station is a backup for the TDRS-A checkout. If the nominal TDRS-A RF check is unsuccessful a direct ground to TDRS-A RF check is required. The Orbiter would be maneuvered out of the deployment attitude into an inertial attitude that ensures 5 minutes of coverage over AGO. Following the check, the Orbiter would then maneuver back into the deployment attitude.

At 9 hours 58 minutes GET the final deployment operations begin. These operations include switching the IUS to internal power, switching TDRS-A to IUS power, inhibiting all Orbiter maneuvering systems, and raising the tilt table to 58 degrees. The IUS/TDRS-A is then ejected at about .4 fps at 10 hours 5 minutes GET.

The detailed flight time line is presented in table I and figure 1.

4.2.3 Ejection to Deorbit

One minute and 9 seconds after ejection, the Orbiter performs an RCS maneuver sequence to achieve the desired position and attitude for an OMS separation maneuver. At 10 hours 16 minutes GET, 11 minutes after ejection and 1 minute after IUS RCS activation, the OMS separation maneuver is performed. The burn ΔV is 69.0 fps and the duration of the burn is 35 seconds. The resultant Orbiter orbit has a 189-n. mi. apogee and 150-n. mi. perigee. This orbit will place the Orbiter approximately 62 n. mi. behind and 33 n. mi. below the IUS/TDRS-A at SRM-1 ignition. After the OMS separation maneuver, the Orbiter orients to an IUS viewing attitude (PLBD in the direction of the IUS) until 10 hours 45 minutes GET, when an attitude maneuver is performed to protect the payload bay from SRM-1 plume impingement. Fourteen minutes after SRM-1, the Orbiter maneuvers out of this protection attitude into a -ZLV attitude. A detailed separation time line is presented in table III .

Following SRM-1 and prior to deorbit preparations, the crew enters a quiesent period for which no major activities have presently been defined. IMU alinements are performed between the eat/sleep periods and, at 28 hours 30 minutes GET, the Orbiter maneuvers to the passive thermal control (PTC) attitude.

Preparation for deorbit begins at 40 hours 15 minutes GET. An IMU alinement is performed during the last darkness pass at 42 hours 45 minutes GET. The Orbiter maneuvers to the deorbit burn attitude at 44 hours 21 minutes GET and 5 minutes later, the deorbit maneuver is performed. The burn ΔV is 261 fps and the burn time is 135 seconds. The landing at KSC occurs at 45 hours 5 minutes GET (11:40 EST). The backup landing opportunity occurs at 46 hours 40 minutes GET (13:15 EST). The complete list of landing opportunities for the flight are found in table VII.

4.3 ORBITER ATTITUDE AND POINTING TIME LINE

The Orbiter conceptual attitude and pointing time line for Flight 7 is presented in table III. This table contains the major attitude sequence of events and time line, the Orbiter orientation with respect to the instantaneous local

vertical/local horizontal (LVLH) reference, and the pointing angle necessary to orient the Orbiter longitudinal axis along the lines of sight to the Sun, Earth, and, if applicable, a second orbiting vehicle. The definitions of the pertinent angles are illustrated in figure 5.

Figure 6 illustrates the IUS and TDRS omni coverage assumed for the attitude time line definition. This coverage is expressed in terms of the allowable pitch/yaw envelope relative to the Orbiter body. Allowance was made (where data exist) for preliminary estimates of Orbiter body blockage, TDRS body blockage of the TDRS omni, and IUS/TDRS tilt table elevation effects.

Figure 7 presents pictorial summaries of the entire onorbit phase of the Flight 7 mission. A detailed explanation of the program that drew these figures and a description of how to interpret each picture may be found on page 3 of reference 3.

4.4 SEPARATION TIME LINE

This separation sequence for TDRS-A is defined in reference 5. It is designed to satisfy all guidelines and constraints outlined in section 3. Table IV summarizes the IUS/TDRS-A separation sequence of events.

Separation is initiated at 10:05:00 GET when the IUS/TDRS-A is released from the tilt table. This corresponds to 00:00:00 phase elapsed time (PET), the reference time for all subsequent events. All Orbiter RCS jets are inhibited prior to release and remain inhibited for the first minute after release. Subsequent to one minute PET, only the +Z RCS jets are inhibited. They remain inhibited until the Orbiter window protection attitude maneuver is initiated 38 minutes after release. At 01:00 PET, a 4 second -X RCS burn is performed, followed by a 45-degree pitchdown maneuver. On completing the pitchdown maneuver at 1:49 PET, the Orbiter is placed in an inertial attitude hold with a 0.5 degree deadband. A 6-second -X RCS burn is then performed. At 10:00 PET, when the IUS/TDRS-A is about 1200 feet in front of and 400 feet above the Orbiter, the IUS attitude control system is activated. One minute later, at 11:00 PET, the Orbiter initiates a 35 second OMS burn. Figures 6(a) and 6(b) show the relative motion of the IUS with respect to the Orbiter during this portion of the separation sequence. Figure 6(c) also shows the payload interrogator (PI) antenna nominal beam width and contours of dynamic pressure caused by the OMS engines (from 11:00 through 11:35 PET). Five seconds after OMS burnout, at 11:40 PET, the attitude deadband is increased to 2 deg/axis and a 45-degree pitchup maneuver is initiated. At 12:27 PET, the pitchup maneuver is stopped and the Orbiter is maintained in inertial attitude hold. As shown in Figure 6(a), this ensures that the IUS/TDRS-A is visible through the overhead window and that the IUS remains within the nominal beam of the PI antenna. At 38:00 PET, the Orbiter +Z RCS jets are enabled and a maneuver to the window protection attitude is initiated. Six minutes later, at 44:00 PET, the Orbiter is at the desired attitude with the belly facing the IUS.

A LVLH attitude hold is initiated at this time in order to maintain this Orbiter-IUS relative attitude. Nominal IUS ignition occurs at 51:00 PET when as shown in Figure 6(d) the Orbiter is approximately 63 n. mi. behind and 36 n. mi.

above the IUS. Nominal IUS motor burn duration is 2 minutes 40 seconds (until 53:40 PET). At 65:00 PET, the IUS motor exhaust particles are sufficiently dispersed, and the Orbiter is free to maneuver out of its window protection attitude.

At the completion of the separation sequence, the maneuvers have consumed 110 pounds of forward tank and 65 pounds of aft tank RCS propellants and 1341 pounds of OMS propellant. The Orbiter is in an orbit with a 188-n. mi. apogee, a 150-n. mi. perigee, and an argument of perigee of +20 degrees.

4.5 NONPROPULSIVE CONSUMABLES

The nonpropulsive consumables loading for Flight 7 is shown in Table IX. The active thermal control system (ATCS) thermal profile is presented in figure 8 (a). The total source power profile is shown in figure 8 (b). Figures 8(c) through 8(e) present the scheduled venting time line for this flight.

4.6 PROPULSIVE CONSUMABLES

The OMS and RCS propellant budgets, along with the Orbiter mass properties time history, are presented in table X. The RCS propellant budget shown is the minimum RCS propellant usage for the mission. The OMS propellant budget shows the propellant usage for mission abort after the OMS-2 burn (case I) and the nominal mission (case II).

5.0 REFERENCES

1. STS Flight Assignment Manifest. JSC-13000-0-6P, Apr. 30, 1979.

2. Shuttle Operational Data Book Revision A, Volume II, JSC-08934, Sept. 1975.

3. Presentation to Management Council, Orbiter Separation Requirements for Upper Stage Plume Avoidance, May 22, 1979.

4. E. Lineberry Separation Sequence review followup to Management Council briefing on Separation Sequence, May 31, 1979.

5. Wilson, W.S.: Orbiter/IUS Separation Sequence for Nominal TDRS-A Deployment. TRW Report 79:2511.1-61, May 17, 1979.

TABLE I.- MAJOR EVENT TIME LINE FOR FLIGHT 7

[Launch February 27, 1981 at 19:35 GMT]

Event	GET, hr:min:sec	Duration, hr:min:sec	Comments
Launch	00:00:00	00:08:10	Feb. 27, 1981 at 19:35 GMT
MECO	00:08:10		h_a = 78 n. mi., h_p = 12 n. mi.
ET separation	00:08:21		ΔV = 4 fps
OMS-1	00:10:10	00:02:11.0	h_a = 150 n. mi., h_p = 56 n. mi., ΔV = 211 fps
OMS-2	00:45:43.0	00:01:45.0	h_a = 150 n. mi., h_p = 150 n. mi., ΔV = 169 fps
Open PLBD	01:20:00	00:05:00	
Transfer IUS To Orbiter power	01:30:00		
Perform IMU alinement	01:55:00	00:25:00	In darkness
Early predeployment checkout	02:25:00		
IUS command link check	02:52:30.0		HTS pass
TDRS RF command check	03:12:00	00:05:00	MIL pass
Orient Orbiter, perform IUS attitude initialization test	03:23:00	00:26:00	Backup TDRS RF command check (ACN) at 3:30
Downlink verification of IUS attitude data	04:14:30		GTS pass
Uplink SV and trim maneuver(s) to Orbiter	04:28:30		
Perform Orbiter trim maneuver(s)	04:57:00		RCS sequence, maximum of two maneuvers performed at apogee and/or perigee
IMU alinement	06:23:00	00:25:00	In darkness
Orient Orbiter, perform IUS attitude initialization	07:53:00		

TABLE I.- Continued

Event	GET, hr:min:sec	Duration, hr:min:sec	Comments
Uplink SV to Orbiter and transfer SV to IUS	08:37:00		IOS pass, HAW backup
Maneuver to deployment attitude	08:53:00		RCS sequence
Raise tilt table to 29°	09:00:00	00:05:00	
Predeployment checkout and TDRS RF check	09:15:00		HAW-HTS
Deploy GO/NO-GO	09:47:00		AGO pass, back-up direct TDRS RF check
Raise tilt table to 58°	09:58:00	00:05:00	
Inhibit RCS thrusters	10:03:00		
Eject IUS/TDRS-A	10:05:00		
Orbiter RCS separation maneuver	10:06:00	00:00:04.0	ΔV = 3 fps
IUS RCS activation	10:15:00		
Orbiter OMS separation maneuver	10:16:00.0	00:00:35.0	h_a = 188.0 n. mi., h_p = 150 n. mi., ΔV = 69 fps, Orbiter maintains communications with IUS/TDRS-A
Lower tilt table	10:25:00		
Orbiter maneuvers to minimize plume damage	10:43:00		
SRM-1	10:56:00		Goodbye TDRS-A
Orbiter maneuvers out of plume damage prevention attitude	11:10:00		RCS sequence
Crew eat period	11:15:00	01:00:00.0	
Crew presleep activity	12:15:00	00:45:00.0	
Crew sleep period	13:00:00	07:15:00.0	
Crew postsleep activity	20:15:00	00:45:00.0	

TABLE I.- Concluded

Event	GET, hr:min:sec	Duration, hr:min:sec	Comments
Crew eat period	21:00:00	01:00:00.0	
IMU alinement	21:30:00	00:25:00.0	In darkness
IMU alinement	27:45:00	00:25:00.0	In darkness
Orbiter maneuvers to passive thermal control attitude	28:30:00		RCS sequence
Crew eat period	29:15:00	01:00:00.0	
Crew presleep activity	30:15:00	00:45:00.0	
Crew sleep period	31:00:00	07:15:00.0	
Crew postsleep activity	38:15:00	00:45:00.0	
Crew eat period	39:00:00	01:00:00.0	
Deorbit preparation	40:15:00		
IMU alinement	42:45:00	00:25:00.0	Last darkness pass
Close PLBD	43:15:00		
Orbiter maneuver to deorbit attitude	43:56:00		RCS sequence
Orbiter attitude adjustment maneuver	44:21:00		RCS sequence
Deorbit burn	44:26:00	00:02:24.0	h_a = 173 n. mi., h_p = 5 n. mi., ΔV = 261 fps
KSC landing	45:05:00		
Backup KSC landing	46:40:00		

TABLE II.- FLIGHT 7 ATTITUDE AND POINTING TIME LINE

EVENT	GET/GMT	GEODETIC			ATTITUDE LVLH/BODY			LOOK ANGLES SUN/EARTH		LOOK ANGLES SUN/EARTH				
	DAY HR MIN SEC	ALT	LAT	LON	PITCH	YAW	ROLL	ROLL	PITCH	PITCH	YAW	MODE	BETA	SUN
OMS-2 C.O. AND CUTOFF	0: 0:48:43.0 55:20:22:43.0	152.3	-27.5	7.9	-15.1 .0	.0 -77.7	180.0 118.5	-38.0 .0	55.4 74.9	52.0 74.9	-31.6 .0	IH	-31.6	[illegible]
MAN. TO -Z LV	0: 1: 0: .0 55:20:34:00.0	151.4	-27.9	112.1	42.1 .0	.0 -77.5	180.0 110.5	-36.0 .0	58.5 132.1	52.1 132.1	-31.7 .0	ROTR	-31.7	1
OPEN PLBD	0: 1:19:00.0 55:20:54:00.0	152.9	14.8	200.1	.0 -73.1	.0 42.6	180.0 97.9	-146.7 .0	73.0 90.0	-70.0 90.0	-31.7 .0	LVLH	-31.7	1
MAN. TO COAS CAL SUNSET	0: 1:52:00.0 55:21:27:00.0	150.4	7.5	325.9	-.0 152.7	-.0 5.1	180.0 -95.7	-59.0 .0	142.1 90.0	158.2 90.0	-31.7 .0	ROTR	-31.7	0
MAN. TO COAS CAL. /IMU ALIGN.	0: 1:54:00.0 55:21:30: .0	150.3	7.7	335.5	-68.1 151.7	-5.2 -71.0	46.5 134.5	100.7 120.4	56.0 22.5	-69.5 -11.5	76.6 19.3	IH	-31.7	0
IMU ALIGN. MAN. TO -Z LV	0: 2:19:00.0 55:21:54:00.0	152.4	-29.6	63.5	72.0 171.5	-5.1 -70.7	46.5 134.4	100.7 136.3	56.1 171.7	-72.0 -130.7	79.6 35.7	IH	-31.8	0
EARLY PRE-DEPLOY. CHECKOUT	0: 2:24:00.0 55:22: 0: .0	152.1	-26.3	94.7	.0 -19.2	-.0 -56.9	180.0 100.3	-50.6 .0	42.8 90.0	30.2 90.0	-31.8 .0	LVLH	-31.8	0
SUNRISE/-Z LV	0: 2:27:31.1 55:22: 2:31.1	151.8	-23.6	94.6	.0 -21.6	-.0 -46.5	180.0 98.2	-60.9 .0	37.1 90.0	20.2 90.0	-31.8 .0	LVLH	-31.8	0
IUS COMMAND CHECK HAW ACS	0: 2:52:37.0 55:22:27:30.0	151.2	19.9	156.4	.0 -35.1	-.7 52.4	180.0 99.2	-147.8 .0	61.2 90.0	-79.7 90.0	-31.8 .0	LVLH	-31.8	1
ICRS RF COMMAND CHECK	0: 3:11:07.0 55:22:46:00.0	151.9	24.4	266.4	.0 159.5	.0 45.9	180.0 -98.4	-121.5 .0	141.7 90.0	-157.6 90.0	-31.5 .0	LVLH	-31.8	1
SUNSET/-Z LV	0: 3:22:29.0 55:22:57:29.0	150.4	8.0	304.9	-.0 152.6	.0 6.6	180.0 -95.5	-61.0 .0	142.9 90.0	159.8 90.0	-31.9 .0	LVLH	-31.9	0
MAN. TO CENTER IUS SCANNER	0: 3:22:00.0 55:22:57:00.0	150.4	7.3	306.1	-.0 152.7	-.0 5.2	180.0 -95.5	-59.4 .0	142.2 90.0	156.4 90.0	-31.9 .0	ROTR	-31.9	0
BACKUP ICRS RF COMMAND CHECK	0: 3:30: .0 55:23: 4:00.0	150.4	-6.0	329.1	-12.6 -147.1	-56.6 -23.4	-17.5 98.3	-157.4 -171.1	131.2 63.1	-133.5 -53.0	-16.8 -9.9	IH	-31.9	0
BEGIN CENTER/IUS SCANNER ROLL .5	0: 3:36:00.0 55:23:12: .0	151.2	-19.2	353.2	15.4 -147.2	-56.5 -23.4	-19.6 98.2	-157.4 -147.5	131.3 98.4	-133.5 -100.0	-16.5 -32.1	ROTR	-31.9	0
FIRST IUS SCANNER ON STAR 1	0: 3:37:12.0 55:23:12:12.0	151.2	-19.5	353.9	16.2 -147.2	-56.5 -23.4	-25.6 92.2	-151.4 -140.3	131.3 98.9	-135.0 -101.4	-21.1 -39.7	ROTR	-31.9	0

TABLE II.- CONTINUED.

EVENT	GET/GMT DAY HR MIN SEC	GEODETIC ALT	GEODETIC LAT	GEODETIC LON	ATTITUDE LVLH/BODY PITCH	ATTITUDE LVLH/BODY YAW	ATTITUDE LVLH/BODY ROLL	LOOK ANGLES SUN/EARTH ROLL	LOOK ANGLES SUN/EARTH PITCH	LOOK ANGLES SUN/EARTH PITCH	LOOK ANGLES SUN/EARTH YAW	MODE	BETA	SUN
STOP MANEUVER/ INERTIAL HOLD	0: 3:37:24.0 58:23:12:24.0	151.2	-19.6	354.6	17.0 -147.2	-56.5 -23.4	-31.6 96.2	-145.4 -134.1	131.7 99.3	-136.5 -133.2	-25.3 -45.1	IH	-31.9	0
CONTINUE/IUS ROLL .5 DEG/SEC	0: 3:38:60.0 58:23:15: .0	151.6	-22.4	4.4	27.4 -147.2	-56.5 -23.4	-31.6 36.2	-145.4 -125.0	131.7 104.7	-136.8 -114.6	-25.3 -52.4	ROTR	-31.5	0
SECOND IUS SCANNER ON STAR 1	0: 3:40:12.0 58:23:15:12.0	151.7	-22.6	5.2	28.2 -147.2	-56.5 -23.4	-25.6 92.2	-151.9 -130.3	131.7 105.1	-135.0 -112.7	-21.1 -47.4	ROTR	-31.9	0
FIRST IUS SCANNER ON STAR 2	0: 3:43:27.0 58:23:18:27.0	152.1	-26.0	18.1	41.2 -147.2	-56.5 -23.4	72.0 -170.2	111.0 144.1	131.3 111.3	-157.7 -115.7	44.5 33.1	ROTR	-31.9	0
STOP MANEUVER/ INERTIAL HOLD	0: 3:43:39.0 58:23:18:39.0	152.1	-26.2	19.0	42.0 -147.2	-56.5 -23.4	78.0 -164.2	105.0 138.9	131.3 111.7	-163.5 -117.8	46.5 37.7	IH	-31.9	0
CONTINUE/IUS ROLL -.5 DEG/SEC	0: 3:45:60.0 58:23:21: .0	152.3	-27.9	25.6	51.4 -147.2	-56.5 -23.4	78.0 -164.2	105.1 148.2	131.3 115.6	-163.5 -119.2	46.5 29.2	ROTR	-31.9	0
SECOND IUS SCANNER ON STAR 2	0: 3:46:12.0 58:23:21:12.0	152.3	-27.9	29.6	52.2 -147.2	-56.5 -23.4	72.0 -170.2	111.1 155.1	131.7 115.9	-157.7 -116.1	44.5 22.3	ROTR	-31.9	0
END IUS SCANNER/ CONTINUE ROLL	0: 3:46:24.0 58:23:21:24.0	152.3	-27.9	30.4	53.0 -147.2	-56.5 -23.4	66.0 -176.2	117.1 161.9	131.3 116.2	-152.6 -117.3	42.0 16.2	ROTR	-31.9	0
THIRD IUS SCANNER ON STAR 1	0: 3:49:27.0 58:23:24:27.0	152.4	-28.6	43.5	65.2 -147.2	-56.5 -23.3	-25.6 92.2	-151.3 -93.4	131.3 120.1	-135.0 -174.2	-21.1 -59.8	ROTR	-31.9	0
END IUS SCANNER/ MAN. TO -Z LV	0: 3:49:39.0 58:23:24:39.0	152.4	-29.6	44.4	66.0 -147.2	-56.5 -23.3	-31.6 86.2	-145.3 -86.5	131.3 120.3	-136.9 174.0	-25.3 -59.5	ROTR	-31.9	0
-Z LV	0: 3:53:60.0 58:23:28:60.0	152.2	-27.0	62.8	.0 -18.1	.0 -60.8	180.0 101.1	-47.7 .0	45.6 90.0	34.6 90.0	-31.9 .0	LVLH	-31.9	0
SUNRISE/-Z LV	0: 3:57:37.0 58:23:32:37.0	151.7	-23.6	77.5	.0 -22.1	-.0 -46.6	180.0 97.9	-61.1 .0	37.1 90.0	20.1 90.0	-31.9 .0	LVLH	-31.9	1
DELIVER S.V. AND TRIM MAN.	0: 4:28:60.0 59: 0: 3:60.0	152.1	26.8	199.1	-.0 -52.6	.0 77.5	180.0 115.4	-147.1 .0	103.0 90.0	-105.4 90.0	-31.9 .0	LVLH	-31.9	1
PERFORM TRIM MAN. IF REQUIRED	0: 4:56:60.0 59: 0:31:60.0	150.3	-.4	295.5	.0 151.2	.0 -10.6	180.0 -95.1	-45.7 .0	132.4 90.0	142.7 90.0	-32.0 .0	LVLH	-32.0	0
SUNSET/-Z LV	0: 6:22:49.0 59: 1:57:49.0	150.4	7.9	260.0	-.0 152.7	.0 6.2	180.0 -95.1	-61.1 .0	142.6 90.0	159.7 90.0	-32.1 .0	LVLH	-32.1	0

TABLE II.- CONTINUED.

EVENT	GET/GMT DAY HR MIN SEC	ALT	GEODETIC LAT	GEODETIC LON	ATTITUDE LVLH/BODY PITCH	ATTITUDE LVLH/BODY YAW	ATTITUDE LVLH/BODY ROLL	LOOK ANGLES SUN/EARTH ROLL	LOOK ANGLES SUN/EARTH PITCH	LOOK ANGLES SUN/EARTH PITCH	LOOK ANGLES SUN/EARTH YAW	MODE	BETA	SUN
MAN. TO IMU ALINE	[illegible]	150.7	3.3	267.4	.0 151.9	-.0 -2.5	-180.0 -95.0	-52.3 -.0	137.8 90.0	-151.0 90.0	-32.1 -.0	ROTR	-32.1	C
IMU ALINE	[illegible]	150.7	-2.6	277.0	-54.5 147.0	-2.9 -69.4	46.6 132.0	99.0 127.3	66.6 55.2	-69.0 -23.1	80.4 27.5	IM	-32.1	C
END ALINE/TO -Z LV	[illegible]	152.8	-27.8	334.2	13.1 145.6	-2.9 -69.3	49.6 131.9	99.0 132.1	66.6 103.1	-69.0 -109.1	60.4 46.3	ROTR	-32.1	C
SUNRISE/-Z LV	[illegible]	151.7	-23.9	52.5	-.0 -22.7	-.0 -46.4	180.0 97.2	-61.1 .0	37.4 90.0	20.1 90.0	-32.2 .0	LVLH	-32.2	C
SUNSET/MAN. TO [illegible] SCANNER	[illegible]	150.6	7.1	237.5	-.0 152.6	.0 6.0	180.0 -94.6	-61.2 .0	142.5 90.0	159.7 92.0	-32.3 .0	ROTR	-32.3	C
INERTIAL CAPTURE/ IUS SCANNER	[illegible]	150.4	-6.4	260.5	-13.6 -147.2	-56.2 -23.4	-20.6 98.2	-157.3 -170.2	131.4 42.4	-133.7 -82.3	-16.9 -9.0	IM	-32.3	C
[illegible] IUS SCANNER ON STAR/ROLL 45	[illegible]	150.6	-10.1	267.5	-5.9 -147.2	-56.2 -23.4	-27.5 94.2	-157.4 -164.3	131.7 86.7	-133.6 -56.6	-16.5 -15.7	ROTR	-32.3	C
FIRST IUS SCANNER ON STAR 1	[illegible]	150.6	-10.5	[illegible]	-5.1 -147.2	-56.2 -23.4	-26.6 92.3	-151.4 -157.6	131.7 87.7	-135.0 -86.9	-21.1 -22.3	ROTR	-32.3	C
SIDE MAN./INERTIAL	[illegible]	150.6	-17.9	259.5	-4.3 -147.2	-56.2 -23.4	-32.6 86.3	-145.4 -151.3	131.3 87.6	-136.9 -91.3	-25.3 -27.2	IM	-32.3	C
CAPTURE/IUS ROLL 45 CYCLE	[illegible]	151.0	-15.4	277.8	6.1 -147.2	-56.2 -23.4	-32.6 86.3	-145.3 -142.3	131.3 93.4	-136.9 -94.3	-25.3 -37.6	ROTR	-32.3	C
SECOND IUS SCANNER ON STAR 1	[illegible]	151.0	-15.7	276.5	6.9 -147.2	-56.2 -23.4	-26.6 92.3	-151.3 -147.7	131.9 93.8	-135.0 -94.5	-21.1 -32.3	ROTR	-32.2	C
FIRST IUS SCANNER ON STAR 2	[illegible]	151.5	-20.6	290.4	23.0 -147.2	-56.2 -23.4	70.9 -170.2	111.2 125.9	131.4 101.0	-157.6 -108.3	44.4 52.7	ROTR	-32.2	C
SIDE MAN./INERTIAL	[illegible]	151.5	-20.9	291.1	26.6 -147.2	-56.2 -23.4	76.3 -164.2	105.2 120.6	131.4 131.4	-163.4 -111.6	46.4 57.5	IM	-32.2	C
CAPTURE/IUS ROLL MAN. [illegible]	[illegible]	152.0	-24.9	304.4	34.1 -147.2	-56.2 -23.4	76.5 -164.2	105.2 132.5	131.7 118.7	-163.4 -115.9	46.4 44.5	ROTR	-32.2	C
SECOND IUS SCANNER ON STAR 2	[illegible]	152.0	-25.1	305.0	34.9 -147.2	-56.2 -23.4	70.9 -170.2	111.2 133.2	131.3 128.5	-157.7 -113.9	44.4 35.3	ROTR	-32.2	C

TABLE II.- CONTINUED.

EVENT	GET/GMT	GEODETIC			ATTITUDE LVLH/BODY			LOOK ANGLES SUN/EARTH		LOOK ANGLES SUN/EARTH				
	DAY HR MIN SEC	ALT	LAT	LON	PITCH	YAW	ROLL	ROLL	PITCH	PITCH	YAW	MODE	BETA	SUN
END IUS SCANNER ON STAR 2	0: 8:12:49.0 59: 7:47:24.1	152.7	-25.7	3[illegible]	73.7 -147.2	-56.2 -27.4	64.9 -176.2	117.2 145.9	131.7 109.9	-152.5 -112.5	41.9 32.0	ROTR	-32.2	[illegible]
THIRD IUS SCANNER ON STAR 1	0: 8:15:27.0 59: 7:50:27.0	152.8	-27.6	311.4	49.0 -147.2	-56.2 -27.4	-26.7 92.2	-151.1 -110.5	131.4 114.4	-135.2 -142.2	-21.2 -55.5	ROTR	-32.3	0
END IUS SCANNER/ MAN. TO -Z LV	0: 8:15:30.0 59: 7:50:30.0	152.7	-27.7	319.2	48.8 -147.2	-56.2 -23.4	-32.7 96.2	-145.1 -103.8	131.4 114.7	-137.0 -152.6	-25.4 -61.9	ROTR	-32.3	0
-Z LV	0: 8:19:00.0 59: 7:54:00.0	152.4	-24.5	337.6	.0 -7.3	-.0 -76.7	180.0 111.1	-38.9 .0	58.2 90.0	51.4 90.0	-32.3 .0	LVLH	-32.3	[illegible]
IUS CHECKOUT AND S-BAND UPLINK	0: 8:36:00.0 59: 8:12: .0	153.3	-8.7	47.1	.0 -77.2	.0 -9.5	180.0 94.9	-114.2 .0	35.9 90.0	-16.6 90.0	-32.3 .0	IH	-32.3	1
MAN. TO DEPLOYMENT ATTITUDE SEQ.	0: 8:49:00.0 59: 8:24:00.0	150.9	15.4	85.5	.0 -72.2	-.0 47.2	180.0 96.3	-145.2 .0	72.0 90.0	-66.1 90.0	-32.3 .0	ROTR	-32.3	1
DEPLOYMENT ATT.	0: 8:52:00.0 59: 8:27:00.0	151.7	20.1	97.3	-76.9 -179.0	-33.7 51.1	-160.0 -170.7	179.9 -37.0	122.0 66.3	-122.0 61.2	.1 -33.5	IH	-32.3	1
TILT TABLE TO 29 DEGREES	0: 9: 4:00.0 59: 8:39:00.0	152.9	29.5	14[illegible]	15.1 -179.0	-33.7 51.1	-160.0 -170.8	179.9 -9.1	122.0 105.9	-122.0 106.0	.0 -5.9	IH	-32.3	1
IUS RF CHECKOUT	0: 9:15: .0 59: 8:49:00.0	151.4	20.2	187.1	59.0 -177.1	-33.7 51.2	-160.0 -170.6	180.0 22.7	122.1 135.5	-122.1 137.8	.0 15.7	IH	-32.4	1
ELEVATE TABLE TO 58 DEGREES	0: 9:57:00.0 59: 9:33: .0	151.5	-22.9	345.2	-128.9 -175.9	-33.9 51.2	-159.9 -170.9	180.0 -165.5	121.9 49.7	-121.9 -48.8	.0 -11.0	IH	-32.4	1
DEPLOYMENT EJECT.	0:10: 4:00.0 59: 9:39:00.0	150.8	-17.1	13.6	-170.9 -176.9	-33.9 51.1	-159.9 -170.8	179.9 -129.1	121.9 35.4	-121.9 -24.2	.1 -26.7	IH	-32.4	1
INITIATE -X RCS MAN.	0:10: 5:00.0 59: 9:40:00.0	150.7	-17.4	17.0	-56.6 -178.5	-33.7 51.2	-159.8 -171.2	-179.9 -122.0	121.6 34.9	-121.6 -19.9	-.1 -28.5	IH	-32.4	1
ORBITER PITCH DOWN MAN./INERTIAL	0:10: 6:49.1 59: 9:41:49.1	150.2	-9.9	19.6	-55.5 -45.6	-10.9 38.3	-142.7 141.9	-179.9 -50.4	76.6 40.5	-76.6 28.5	-.1 -30.0	ROTR	-32.4	1
IUS RCS ACTIVATION	0:10:15: .0 59: 9:49:00.0	150.1	5.7	46.7	-18.1 -45.6	-10.9 38.3	-142.7 141.9	-179.9 -40.9	76.6 72.9	-76.6 67.1	-.1 -39.5	ROTR	-32.4	1
INITIATE OMS SEP. MAN.	0:10:15:00.0 59: 9:51: .0	150.2	9.5	52.0	-19.1 -45.6	-10.9 38.3	-142.7 141.9	-179.9 -40.0	76.6 76.2	-75.6 2.2	-.1 -38.6	ROTR	-32.4	1

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TABLE II.- CONTINUED.

EVENT	GET/GMT DAY HR MIN SEC	GEODETIC ALT	 LAT	 LON	ATTITUDE LVLH/BODY PITCH	 YAW	 ROLL	LOOK ANGLES SUN/EARTH ROLL	 PITCH	LOOK ANGLES SUN/EARTH PITCH	 YAW	MODE	BETA	SUN
TERMINATE CMS MAN.	0:10:16:35.0 55: 5:51:35.0	150.4	9.6	50.0	-11.7 -45.6	-37.9 34.3	-142.7 141.5	-179.9 -39.5	76.6 78.5	-76.6 75.2	-.1 -39.6	IH	-32.4	1
INITIATE PITCH UP 1 DEG/SEC	0:10:16:47.0 55: 5:51:47.0	150.4	9.8	52.3	-11.7 -45.7	-17.9 38.6	-142.7 142.0	-180.0 -39.5	76.9 78.5	-76.9 75.2	-.0 -39.5	ROTR	-32.4	1
INERTIAL HOLD	0:10:17:27.0 55: 5:52:27.0	150.6	11.2	54.9	-53.1 -111.7	-34.3 51.0	-161.1 -156.7	-179.9 -55.2	123.7 48.7	-123.7 32.6	-.1 -33.4	IH	-32.4	1
MAN. TO [illegible] PROT. ATT./ORB	0:10:42:00.0 55: 6:16: .0	175.8	22.8	150.6	153.0 -25.5	-.0 -15.9	180.0 94.6	-100.7 -180.0	37.1 117.0	-6.9 -117.0	-32.5 -.0	ROTR	-32.5	1
INERTIAL HOLD/TUS IGNITION	0:10:55:00.0 55: 6:30:00.0	165.6	1.4	201.3	153.0 -70.7	.0 32.1	180.0 95.1	-143.1 -180.0	63.6 117.0	-56.1 -117.0	-32.5 -.0	IH	-32.5	0
-Z LV	0:11: 9:00.0 55: 6:45: .0	156.8	-27.2	243.6	-.0 174.5	.0 -60.0	180.0 -98.7	-72.6 .0	53.3 90.0	93.9 90.0	-32.5 .0	LVLH	-32.5	0
BEGIN SLEEP	0:13: 9:00.0 55: 8:45: .0	153.0	-5.3	[illegible]	-.0 -27.9	-.0 -7.6	180.0 74.0	-120.2 .0	38.7 90.0	-21.9 90.0	-32.7 .0	LVLH	-32.7	1
END SLEEP/-Z LV	0:20:15: .0 55:15:49:00.0	166.7	-23.7	114.4	.0 146.1	-.0 -67.4	180.0 -96.5	-73.2 .0	92.3 90.0	92.8 90.0	-33.2 .0	LVLH	-33.2	0
MAN. TO IMU ALIGN.	0:21:24:00.0 55:17: 0: .0	181.9	11.7	21.4	-.0 152.6	-.0 16.9	180.0 -93.0	-81.6 .0	146.3 90.0	174.4 90.0	-33.3 .0	ROTR	-33.3	1
IMU ALIGN.	0:21:30: .0 55:17: 4:00.0	155.7	2.1	37.7	-64.7 144.4	.0 -69.3	47.2 129.2	99.5 132.8	66.7 21.3	-70.6 -14.8	80.0 15.5	IH	-33.3	0
END IMU ALIGN./ MAN. TO -Z LV	0:21:45: .0 55:17:19:00.0	167.2	-23.0	88.6	-9.6 144.6	.1 -69.3	47.2 129.0	99.5 132.8	86.6 80.2	-70.4 -75.7	79.9 46.3	ROTR	-33.3	0
-Z LV	0:21:54:00.0 55:17:3[illegible]: .0	178.1	-29.5	129.6	.0 -11.4	-.0 -60.5	180.0 106.9	-38.2 .0	62.5 90.0	56.5 90.0	-33.3 .0	IH	-33.3	0
IMU ALIGN.	1: 7:45: .0 55:23:19:00.0	158.8	-19.7	340.6	-21.3 144.2	.0 -69.2	46.6 129.0	99.6 133.6	86.9 68.7	-72.0 -60.5	80.0 42.5	IH	-33.6	0
END IMU ALIGN./ MAN. TO PTC	1: 4:19:00.0 55:23:54:00.0	151.6	1.7	119.9	117.6 144.2	1.0 -69.1	46.9 129.1	99.5 -44.9	87.0 152.4	-72.6 159.7	80.0 -19.1	ROTR	-33.7	1
BEGIN PTC/ROLL .2 DEG/SEC	1: 4:30: .0 56: 0: 4:00.0	151.6	19.3	154.2	70.0 -96.1	-55.9 -14.2	90.0 -18.4	-.5 156.3	89.6 121.8	89.6 -124.1	-.5 20.0	ROTR	-33.7	1

TABLE II.- CONCLUDED.

EVENT	GET/GMT DAY HR MIN SEC	GEODETIC ALT	GEODETIC LAT	GEODETIC LON	ATTITUDE LVLH/BODY PITCH	ATTITUDE LVLH/BODY YAW	ATTITUDE LVLH/BODY ROLL	LOOK ANGLES SUN/EARTH ROLL	LOOK ANGLES SUN/EARTH PITCH	LOOK ANGLES SUN/EARTH PITCH	LOOK ANGLES SUN/EARTH YAW	MODE	BETA	SUN
BEGIN SLEEP	1: [illegible] .0 63: 2:34:[illegible]	177.9	-29.2	35[illegible]	-55.1 -96.1	-55.7 -14.2	90.6 -18.4	-.4 39.6	69.6 62.9	89.5 56.0	-.4 34.4	ROTR	-33.8	0
END SLEEP	1:14:15: .0 63: 9:49:[illegible]	1[illegible]	-12.7	14[illegible]	-177.1 -96.1	-55.3 -14.2	-97.7 161.6	179.9 135.1	69.9 63.0	-89.5 -54.2	.1 39.0	ROTR	-34.2	0
END PTC/MAN. TO IMU	1:16:[illegible] .0 63:11:34:[illegible].1	1[illegible]3.9	-27.9	200.7	-75.8 -96.1	-55.2 -14.1	92.7 -19.3	-.1 20.3	89.5 57.4	89.5 55.7	-.1 17.0	ROTR	-34.3	0
[illegible] INERTIAL	1:16:15: .0 63:11:49:[illegible]	1[illegible]3.2	-15.6	250.6	74.1 144.3	2.6 -69.2	46.2 129.2	99.5 124.6	67.5 153.9	-75.0 -170.7	83.1 13.2	IH	-34.3	1
IMU ALIGN.	1:19:45: .0 63:14:19:[illegible]	1[illegible]7.9	-9.4	93.2	-50.1 144.3	2.9 -69.3	46.1 129.3	99.5 137.4	-7.5 40.0	-75.1 -31.7	60.1 25.8	IH	-34.4	0
[illegible]	1:19:1[illegible] .0 63:14:49:[illegible]	1[illegible]5.4	-19.4	2[illegible]	65.2 144.2	7.3 -69.3	45.1 129.3	99.5 126.5	47.5 159.0	-75.[illegible] -166.[illegible]	80.1 17.5	IH	-34.5	1

ORIGINAL PAGE IS OF POOR QUALITY

TABLE III.- SEPARATION MANEUVER SUMMARY OF EVENTS FOR FLIGHT 7

GET, hr:min:sec	PET, min:sec	Event	Remarks
10:05:00	0:00	Release IUS from tilt table	ΔV = 0.40 fps; IUS +X axis pointed 180° away from Sun; Orbiter pitch/yaw/roll = -100.90°/-33.90°/200.00°; RCS inactive
	1:00	Begin 4-second -X RCS burn	PRCS with +Z jets inhibited
	1:04	End -X burn; begin 45° Orbiter	ΔV = 1.1 fps; accelerate to -1.0°/sec pitch rate
	1:49	End pitch-down maneuver; initiate Orbiter inertial hold; begin 6-sec -X RCS burn	Deadband = 0.5°/axis
	1:55	End -X burn	ΔV = 1.7 fps
	10:00	IUS attitude control system activation	Orbiter-IUS range = 1306 ft; IUS -X axis pointed ~ 14° away from Sun, due to gravity gradient and aero torques
10:16:00	11:00	Begin 35-second OMS burn	Orbiter pitch/yaw/roll = -14.07°/-10.87°/217.27°
	11:35	End OMS burn	ΔV = 67.6 fps; h_A = 188 n. mi., h_p = 150 n. mi., argument of perigee = 20°.
	11:40	Begin 45° Orbiter pitch up maneuver	Accelerate to +1.0°/sec pitch rate
	12:27	End pitch-up maneuver; initiate Orbiter inertial hold	Deadband = 2.0°/axis; IUS visible through overhead window
	34:00	Orbiter-IUS range = 20 n. mi.	Max RF communication distance
10:43:00	38:00	Orbiter begins maneuvering to window-protection attitude	Enable +Z jets

TABLE III.- Concluded

GET, hr:min:sec	PET, min:sec	Event	Remarks
	44:00	Orbiter achieves window-protection attitude; begins LVLH attitude hold	Orbiter pitch/yaw/roll = -177°/0°/180°
	45:00	IUS SRM ordinance enable	
	45:22	Orbital sunset	
10:56:00	51:00	Nominal IUS SRM-1 ignition; Orbiter begins inertial hold	IUS in inertial hold @ roll/pitch/yaw = -119°/12°/0° wrt local vertical
	53:40	Nominal IUS SRM-1 burnout	
11:10:00	65:00	Orbiter free to maneuver out of window-protection attitude	

TABLE IV.- FLIGHT 7 WEIGHTS AND CENTERS OF GRAVITY DATA

Component	Wt, lb	X_{cg}, in.	Y_{cg}, in.	Z_{cg}, in.
Orbiter dry weight	169 242.0	1106.1	0.1	369.6
Nonpropulsive consumables	5 165.6	917.5	-6.1	351.3
MPS propulsive	5 206.0	1406.7	6.4	353.9
OMS propulsive	17 700.0	1429.1	0.0	476.2
RCS propulsive	5 361.0	1040.0	1.5	438.9
Payload	49 234.0	1053.1	-1.6	394.9

TABLE V.- ASSUMED COMMUNICATIONS NETWORK AVAILABLE TO SUPPORT FLIGHT 7 (FEBRUARY 27, 1981)

(a) GSTDN

Station	Geodetic latitude positive N, deg	Longitude positive E, deg	Altitude, ft
ACN	-7.90	345.67	1 743
BDA	32.18	295.34	-111
Goldstone (GDS)	35.16	243.13	3 014
ETC	39.00	283.16	-7
GWM	13.22	144.74	381
Kwajalein Island (KWA) (C-band)	9.40	167.48	37
HAW	21.99	200.35	3 739
MAD	40.27	355.83	2 650
Merritt Island (MIL)	28.35	279.22	-178
Orroral (ORR)	-35.45	148.98	3 039
QUI	-0.62	281.42	11 640
AGO	-32.98	289.33	2 318
Fairbanks, Alaska (ULA)	64.83	212.48	--

TABLE V.- Concluded

(b) AFSCF

Station	Geodetic latitude positive N, deg	Longitude positive E, deg	Altitude, ft
Cape (TEL-4)	28.35	279.31	48
Guam (GTS)	13.61	144.85	528
HTS	21.57	201.74	942
IOS	-4.67	55.48	1936
New Hampshire	42.52	288.37	692
Thule (TTS)	76.52	291.48	466
Vandenberg (VTS)	34.82	239.50	1001

TABLE VI.- FLIGHT 7 STATION CONTACT OPPORTUNITIES FOR COMMUNICATIONS AND NAVIGATION

(a) GSTDN network coverage for nominal flight [OMS-2 through deorbit]

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
ACN	00:01:55:27	00:02:02:19	6:52	25	331
KMR[a]	00:02:43:23	00:02:50:44	7:21	82	152
HAW	00:02:52:23	00:02:59:43	7:20	60	174
GDS	00:03:03:03	00:03:09:01	5:58	16	467
WHS[b]	00:03:05:09	00:03:11:59	6:50	22	369
MIL	00:03:11:26	00:03:17:36	6:10	14	505
ACN	00:03:31:17	00:03:37:25	6:08	--	--
GWM	00:04:13:57	00:04:21:08	7:11	39	233
KMR	00:04:19:55	00:04:24:58	5:03	8	644
HAW	00:04:28:10	00:04:34:54	6:44	20	385
GDS	00:04:38:41	00:04:43:07	4:26	8	668
WHS	00:04:41:00	00:04:45:52	4:41	8	672
QUI	00:04:50:12	00:04:56:36	6:25	17	432
GWM	00:05:49:35	00:05:56:04	6:29	17	438
HAW	00:06:03:47	00:06:10:32	6:45	20	380
QUI	00:06:25:11	00:06:32:01	6:50	24	338
IOS	00:07:02:10	00:07:08:00	5:50	12	539
GWM	00:07:27:20	00:07:29:48	2:28	4	817
HAW	00:07:38:57	00:07:46:18	7:21	63	168

[a]Kwajalein Island C-band; used for tracking support.
[b]White Sands; included for information.

TABLE VI.- Continued

(a) Continued

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
AGO	00:08:09:31	00:08:09:45	0:13	6	756
IOS	00:08:36:44	00:08:43:56	7:12	41	224
HAW	00:09:14:33	00:09:20:58	6:25	16	449
AGO	00:09:41:41	00:09:46:24	4:42	18	426
GWM	00:10:38:29	00:10:43:13	4:44	--	--
KMR	00:10:43:34	00:10:50:25	6:50	15	557
AGO	00:11:17:01	00:11:22:38	5:37	29	340
ACN	00:11:31:32	00:11:38:26	6:54	21	387
GWM	00:12:13:24	00:12:21:13	7:48	29	348
KMR	00:12:18:58	00:12:27:17	8:19	60	212
AGO	00:12:53:13	00:12:58:14	5:01	18	467
ACN	00:13:07:32	00:13:14:24	6:52	22	364
GWM	00:13:49:24	00:13:57:16	7:52	26	380
KMR	00:13:56:47	00:14:01:24	4:36	6	842
AGO	00:14:30:23	00:14:31:33	1:10	5	825
QUI	00:16:06:52	00:16:11:33	4:40	7	688
QUI	00:17:41:34	00:17:48:53	7:19	75	154
MAD	00:18:03:30	00:18:07:42	4:12	6	767
ORR	00:18:44:18	00:18:49:28	5:09	14	591
QUI	00:19:19:25	00:19:23:08	3:43	5	749
MIL	00:19:23:34	00:19:24:48	1:14	3	857
BDA	00:19:25:47	00:19:26:28	0:42	5	767

TABLE VI.- Continued

(a) Continued

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
BDA	00:19:26:55	00:19:30:12	3:17	7	716
MAD	00:19:38:59	00:19:42:57	3:57	6	809
IOS	00:19:55:33	00:20:02:35	7:03	15	556
ORR	00:20:19:56	00:20:25:37	5:41	19	477
MIL	00:20:56:22	00:21:03:14	6:51	21	381
BDA	00:21:00:08	00:21:07:05	6:58	21	387
IOS	00:21:30:55	00:21:39:14	8:19	43	267
ORR	00:21:55:60	00:21:59:34	3:34	12	595
WHS	00:22:27:37	00:22:32:47	5:11	9	645
MIL	00:22:31:53	00:22:39:29	7:36	70	169
ETC	00:22:34:19	00:22:39:24	5:04	8	692
BDA	00:22:35:40	00:22:43:09	7:29	32	292
IOS	00:23:09:07	00:23:13:34	4:27	6	851
HAW	00:23:51:53	00:23:54:57	3:03	5	768
GDS	01:00:01:08	01:00:05:59	4:51	10	616
WHS	01:00:02:19	01:00:09:24	7:05	24	358
MIL	01:00:07:50	01:00:15:38	7:48	82	167
ETC	01:00:09:41	01:00:14:55	5:14	8	703
BDA	01:00:11:36	01:00:18:49	7:14	21	421
ACN	01:00:28:30	01:00:29:10	0:40	5	879
ACN	01:00:29:44	01:00:34:12	4:28	9	733
KMR	01:01:16:41	01:01:23:21	6:39	19	398

TABLE VI.- Continued

(a) Continued

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
HAW	01:01:25:22	01:01:32:37	7:14	41	225
GDS	01:01:36:05	01:01:42:16	6:10	17	458
WHS	01:01:37:56	01:01:45:23	7:27	31	306
MIL	01:01:44:42	01:01:51:32	6:50	32	307
ETC	01:01:47:13	01:01:47:13	0:53	3	942
BDA	01:01:48:25	01:01:52:01	3:35	7	783
BDA	01:01:52:26	01:01:53:12	0:46	7	783
ACN	01:02:03:06	01:02:11:34	8:28	88	188
GWM	01:02:48:30	01:02:54:04	5:34	11	577
GTS	01:02:48:37	01:02:54:05	5:28	10	589
KMR	01:02:52:33	01:02:59:25	6:53	23	343
HAW	01:03:01:26	01:03:08:40	7:13	31	283
GDS	01:03:11:46	01:03:18:02	6:17	14	534
WHS	01:03:13:57	01:03:20:54	6:58	17	480
MIL	01:03:20:40	01:03:26:08	5:28	8	728
QUI	01:03:24:53	01:03:29:29	4:36	7	799
ACN	01:03:40:18	01:03:46:45	6:27	--	--
GWM	01:04:23:31	01:04:30:49	7:18	--	--
KMR	01:04:31:35	01:04:33:06	1:32	3	853
HAW	01:04:37:57	01:04:44:52	6:55	19	420
GDS	01:04:48:37	01:04:51:52	3:15	5	836
WHS	01:04:51:22	01:04:54:36	3:14	4	863

TABLE VI.- Continued

(a) Continued

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
QUI	01:04:59:10	01:05:07:28	8:18	64	203
IOS	01:05:38:52	01:05:41:11	2:19	4	860
GWM	01:06:00:49	01:06:06:00	5:11	9	637
HAW	01:06:14:00	01:06:21:34	7:34	31	306
QUI	01:06:36:07	01:06:42:36	6:29	12	649
IOS	01:07:12:36	01:07:19:53	7:17	35	260
HTS	01:07:50:16	01:07:58:17	8:01	52	220
AGO	01:08:17:43	01:08:19:30	1:47	11	660
AGO	01:08:20:35	01:08:23:04	2:29	14	586
IOS	01:08:49:11	01:08:55:13	6:02	13	522
GWM	01:09:16:51	01:09:17:48	0:57	3	893
KMR	01:09:21:22	01:09:25:23	4:02	6	817
HAW	01:09:26:58	01:09:32:26	5:28	8	738
AGO	01:09:53:32	01:09:59:21	5:48	28	366
ACN	01:10:08:55	01:10:10:10	1:15	6	761
ACN	01:10:10:30	01:10:14:50	3:34	8	684
GWM	01:10:50:35	01:10:56:57	6:22	12	587
KMR	01:10:55:46	01:11:03:42	7:56	34	303
AGO	01:11:29:41	01:11:35:13	5:32	26	373
ACN	01:11:43:54	01:11:51:25	7:32	74	162
GWM	01:12:25:54	01:12:34:06	8:12	84	180
KMR	01:12:31:60	01:12:39:27	7:27	19	481

TABLE VI.- Continued

(a) Concluded

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
AGO	01:13:06:07	01:13:08:24	2:17	12	610
AGO	01:13:09:51	01:13:10:13	0:22	12	610
AGO	01:13:10:19	01:13:10:33	0:14	5	811
ACN	01:13:21:27	01:13:10:33	3:34	7	685
ACN	01:13:25:40	01:13:25:57	0:17	3	862
GWM	01:14:02:51	01:14:08:58	6:07	10	688
QUI	01:16:18:29	01:16:25:18	6:49	21	372
MAD	01:16:18:29	01:16:43:58	2:28	4	836
QUI	01:17:54:33	01:18:01:09	6:36	19	400
MAD	01:18:15:47	01:18:20:08	4:21	6	757
IOS	01:18:34:17	01:18:36:55	2:38	4	911
ORR	01:18:56:45	01:19:02:25	5:40	17	510
MIL	01:19:33:55	01:19:39:18	5:23	10	605
BDA	01:19:37:23	01:19:43:26	6:02	13	530
MAD	01:19:52:29	01:19:53:41	1:12	3	904
ORR	01:20:32:35	01:20:37:55	5:30	17	505

TABLE VI.- Continued

(b) AFSCF RTS coverage
[OMS-2 through 24 hours in parking orbit]

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
HTS	00:02:52:42	00:02:59:59	7:17	45	210
VTS	00:03:02:09	00:03:08:46	6:36	18	426
TEL-4	00:03:11:26	00:03:17:38	6:12	14	497
GTS	00:04:14:01	00:04:21:11	7:10	37	244
HTS	00:04:28:34	00:04:35:09	6:34	18	425
VTS	00:04:37:31	00:04:43:07	5:35	10	594
GTS	00:05:49:36	00:05:56:10	6:33	18	424
HTS	00:06:04:11	00:06:10:51	6:40	19	404
IOS	00:07:02:10	00:07:08:00	5:50	12	539
GTS	00:07:27:11	00:07:30:02	2:51	4	801
HTS	00:07:39:19	00:07:46:40	7:21	62	171
IOS	00:08:36:44	00:08:43:56	7:12	41	224
HTS	00:09:14:56	00:09:21:20	6:24	16	457
GTS	00:10:38:23	00:10:43:20	4:58	--	--
GTS	00:12:13:22	00:12:21:14	7:51	30	332
GTS	00:13:49:25	00:13:57:14	7:48	25	397
TEL-4	00:19:23:22	00:19:24:58	1:37	3	849
IOS	00:19:55:33	00:20:02:35	7:03	15	556
TEL-4	00:20:56:21	00:21:03:14	6:53	22	373
IOS	00:21:30:55	00:21:39:14	8:19	43	267
TEL-4	00:22:31:53	00:22:39:29	7:36	73	165

TABLE VI.- Concluded

(b) Concluded

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
NHS	00:22:37:40	00:22:38:18	0:38	3	910
IOS	00:23:09:07	00:23:13:34	4:27	6	851
HTS	00:23:51:17	00:23:55:40	4:23	7	702
VTS	01:00:00:18	01:00:05:41	5:23	9	633
TEL-4	01:00:07:50	01:00:15:38	7:48	86	166

TABLE VI.- Continued

(c) GSTDN coverage for alternate deployment opportunities

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
ACN	00:01:55:27	00:02:02:19	6:52	25	331
KMR	00:02:43:23	00:02:50:44	7:21	82	152
HAW	00:02:52:23	00:02:59:43	7:20	60	174
GDS	00:03:03:03	00:03:09:01	5:58	16	467
WHS	00:03:05:09	00:03:11:59	6:50	22	369
MIL	00:03:11:26	00:03:17:36	6:10	14	505
ACN	00:03:31:17	00:03:37:25	6:08	--	--
GWM	00:04:13:57	00:04:21:08	7:11	39	233
KMR	00:04:19:55	00:04:24:58	5:03	8	644
HAW	00:04:28:10	00:04:34:54	6:44	20	385
GDS	00:04:38:41	00:04:43:07	4:26	8	668
WHS	00:04:41:00	00:04:45:52	4:41	8	672
QUI	00:04:50:12	00:04:56:36	6:25	17	432
GWM	00:05:49:35	00:05:56:04	6:29	17	438
HAW	00:06:03:47	00:06:10:32	6:45	20	380
QUI	00:06:25:11	00:06:32:01	6:50	24	338
GWM	00:07:27:20	00:07:29:48	2:28	4	817
HAW	00:07:38:57	00:07:46:18	7:21	63	168
AGO	00:08:09:31	00:08:09:45	0:13	6	756
HAW	00:09:14:33	00:09:20:58	6:25	16	449
AGO	00:09:41:41	00:09:46:24	4:42	18	426

TABLE VI.- Continued

(c) Continued

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
GWM	00:10:38:51	00:10:39:48	0:57	5	785
GWM	00:10:40:08	00:10:42:37	2:28	6	750
KMR	00:10:43:52	00:10:49:44	5:52	12	536
AGO	00:11:16:42	00:11:21:40	4:58	25	334
ACN	00:11:30:54	00:11:37:36	6:42	20	381
GWM	00:12:12:54	00:12:19:50	6:56	25	329
KMR	00:12:18:28	00:12:25:46	7:18	54	184
AGO	00:12:52:01	00:12:56:38	4:37	15	466
ACN	00:13:06:04	00:13:12:52	6:48	22	357
GWM	00:13:48:11	00:13:55:00	6:50	22	360
KMR	00:13:56:03	00:13:58:30	2:27	4	823
AGO	00:14:28:32	00:14:29:15	0:43	4	823
QUI	00:16:04:03	00:16:08:21	4:18	7	697
QUI	00:17:37:49	00:17:45:06	7:17	83	149
MAD	00:18:00:04	00:18:03:37	3:33	5	774
ORR	00:18:40:38	00:18:42:03	1:25	8	664
ORR	00:18:44:06	00:18:44:06	0:20	9	633
QUI	00:19:14:42	00:19:18:47	4:05	6	721
BDA	00:19:21:26	00:19:21:51	0:25	4	818
BDA	00:19:22:25	00:19:25:28	3:03	6	736
MAD	00:19:34:53	00:19:37:48	2:55	5	806
IOS	00:19:51:27	00:19:57:04	5:37	11	568

TABLE VI.- Concluded

(c) Concluded

Station ID	GET AOS, day:hr:min:sec	GET LOS, day:hr:min:sec	Tracking time, min:sec	Max elev., deg	Min. slant range, n. mi.
ORR	60:20:15:24	00:20:19:56	4:33	15	474
MIL	00:20:51:10	00:20:57:50	6:40	19	400
BOA	00:20:54:57	00:21:01:39	6:42	19	399
ORR	00:21:50:36	00:21:53:22	2:46	11	583
WHS	00:22:21:45	00:22:26:34	4:49	8	669
MIL	00:22:25:55	00:22:33:18	7:23	63	169
ETC	00:22:28:31	00:22:33:05	4:34	7	702
BDA	00:22:29:46	00:22:36:52	7:07	30	291
HAW	00:23:45:10	00:23:47:45	2:35	4	813
GDS	00:23:54:35	00:23:59:01	4:26	9	638
WHS	00:23:55:38	01:00:02:26	6:49	21	371
MIL	01:00:01:23	01:00:08:34	7:11	80	154
ETC	01:00:03:10	01:00:07:47	4:37	7	699
BDA	01:00:04:59	01:00:11:41	6:42	19	407
ACN	01:00:22:49	01:00:26:02	3:13	5	760

TABLE VII.- FLIGHT 7 LANDING OPPORTUNITIES FOR FEBRUARY 27, 1981 AT 19:35:00

NAME=KSC LAT= 28.615 LONG= -80.695 RADIUS= 3441.

ORBIT	XRNG	TASR	TBSS	GETL	LLT	SELV
1 A	-1.	7 58	3 32	0 0 14	14 49	43.
2 D	-117.	9 33	1 57	0 1 49	16 24	26.
3 D	-471.	11 8	0 22	0 3 25	17 60	6.
14 A	-858.	3 15	8 16	0 19 30	10 5	37.
15 A	-361.	4 50	6 41	0 21 5	11 40	50.
16 A	-64.	6 25	5 7	0 22 40	13 15	53.
17 D	-13.	8 0	3 32	1 0 15	14 50	43.
18 D	-218.	9 35	1 57	1 1 50	16 25	26.
19 D	-644.	11 10	0 22	1 3 25	18 0	6.
30 A	-662.	3 17	8 16	1 19 30	10 5	37.
31 A	-230.	4 52	6 42	1 21 5	11 40	51.
32 A	-16.	6 27	5 7	1 22 40	13 15	53.
33 D	-58.	8 2	3 32	2 0 15	14 50	43.
34 D	-347.	9 37	1 57	2 1 51	16 26	26.
35 D	-838.	11 11	0 22	2 3 25	18 0	6.
46 A	-487.	3 18	8 17	2 19 30	10 5	38.
47 A	-126.	4 53	6 42	2 21 5	11 40	51.
48 D	-1.	6 28	5 7	2 22 41	13 16	54.

$ 800 =STACN,F7RAD :

TABLE VIII.- FLIGHT 7 SUNRISE/SUNSET DATA

GETS= 0: 0: 0 GETF 46:40: 0 VECFIL /FILEO

ORB		GET D	GET H	GET M	GET S	GMT MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LULH PITCH	LULH YAW
1	TERMIN SET	0	-1	-12	-35	2	27	18	22	24	17.4	-5.0	151.6	180.0	31.4
1	EFF SUNSET	0	-1	-7	-36	2	27	18	27	24	8.8	[illegible] 3	150.9	-180.0	31.5
1	ORB SUNSET	0	-1	-7	-36	2	27	18	27	24	8.8	12.3	150.9	-180.0	31.5
1	MIDNIGHT	0	0	-50	-4	2	27	18	44	55	-21.8	72.2	148.7	-90.0	31.5
1	ORB SUNRISE	0	0	-32	-32	2	27	19	2	27	-23.9	145.0	148.6	-19.8	31.5
1	EFF SUNRISE	0	0	-32	-32	2	27	19	2	27	-23.9	145.0	148.6	-19.8	31.5
1	TERMIN RISE	0	0	-27	-35	2	27	19	7	25	-17.3	163.8	149.1	-.0	31.5
2	ORBIT NOON	0	0	-5	-3	2	27	19	29	56	21.9	-119.0	152.0	90.0	31.5
2	TERMIN SET	0	0	17	29	2	27	19	52	29	17.1	-27.5	151.6	-180.0	31.6
2	EFF SUNSET	0	0	22	29	2	27	19	57	29	8.6	-10.2	150.9	-180.0	31.6
2	ORB SUNSET	0	0	22	29	2	27	19	57	29	8.6	-10.2	150.9	-180.0	31.6
2	MIDNIGHT	0	0	39	60	2	27	20	14	60	-22.0	49.8	148.7	-90.0	31.6
2	ORB SUNRISE	0	0	57	32	2	27	20	32	32	-23.8	122.6	148.6	-19.8	31.6
2	EFF SUNRISE	0	0	57	32	2	27	20	32	32	-23.8	122.6	148.6	-19.8	31.6
2	TERMIN RISE	0	1	2	29	2	27	20	37	30	-17.0	141.3	149.1	.0	31.6
3	ORBIT NOON	0	1	25	1	2	27	21	0	1	22.1	-141.4	152.0	90.0	31.7
3	TERMIN SET	0	1	47	34	2	27	21	22	34	16.9	-49.9	151.6	180.0	31.7
3	EFF SUNSET	0	1	52	34	2	27	21	27	34	8.3	-32.7	150.9	-180.0	31.7
3	ORB SUNSET	0	1	52	34	2	27	21	27	34	8.3	-32.7	150.9	-180.0	31.7
3	MIDNIGHT	0	2	10	5	2	27	21	45	5	-22.2	27.3	148.7	-90.0	31.7
3	ORB SUNRISE	0	2	27	36	2	27	22	2	37	-23.6	100.1	148.6	-19.9	31.8
3	EFF SUNRISE	0	2	27	36	2	27	22	2	37	-23.6	100.1	148.6	-19.9	31.8
3	TERMIN RISE	0	2	32	34	2	27	22	7	35	-16.8	118.8	149.1	-.0	31.8
4	ORBIT NOON	0	2	55	6	2	27	22	30	6	22.3	-163.9	152.9	90.0	31.8

SRSS MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORB		GET D	GET H	GET M	GET S	GMT MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
4	TERMIN SET	0	3	17	39	2	27	22	52	39	16.7	-72.4	151.6	-180.0	31.8
4	EFF SUNSET	0	3	22	40	2	27	22	57	40	8.0	-55.2	150.9	-169.0	31.9
4	ORB SUNSET	0	3	22	40	2	27	22	57	40	8.0	-55.2	150.9	-169.0	31.9
4	MIDNIGHT	0	3	40	10	2	27	23	15	10	-22.4	4.9	148.7	-90.0	31.9
4	ORB SUNRISE	0	3	57	41	2	27	23	32	41	-23.5	77.7	148.6	-19.9	31.9
4	EFF SUNRISE	0	3	57	41	2	27	23	32	41	-23.5	77.7	148.6	-19.9	31.9
4	TERMIN RISE	0	4	2	39	2	27	23	37	40	-16.5	96.3	149.1	.0	31.9
5	ORBIT NOON	0	4	25	11	2	28	0	0	11	22.5	173.7	152.0	90.0	31.9
5	TERMIN SET	0	4	47	44	2	28	0	22	44	16.4	-94.9	151.6	-180.0	32.0
5	EFF SUNSET	0	4	52	45	2	28	0	27	45	7.7	-77.6	150.9	-159.9	32.0
5	ORB SUNSET	0	4	52	45	2	28	0	27	45	7.7	-77.6	150.9	-159.9	32.0
5	MIDNIGHT	0	5	10	15	2	28	0	45	15	-22.6	-17.5	148.7	-90.0	32.0
5	ORB SUNRISE	0	5	27	45	2	28	1	2	46	-23.3	55.2	148.6	-19.9	32.0
5	EFF SUNRISE	0	5	27	45	2	28	1	2	46	-23.3	55.2	148.6	-19.9	32.0
5	TERMIN RISE	0	5	32	44	2	28	1	7	45	-16.3	73.9	149.1	-.0	32.0
6	ORBIT NOON	0	5	55	16	2	28	1	30	16	22.7	151.2	152.0	90.0	32.1
6	TERMIN SET	0	6	17	48	2	28	1	52	49	16.2	-117.4	151.5	-180.0	32.1
6	EFF SUNSET	0	6	22	50	2	28	1	57	51	7.4	-100.1	150.9	-159.9	32.1
6	ORB SUNSET	0	6	22	50	2	28	1	57	51	7.4	-100.1	150.9	-159.9	32.1
6	MIDNIGHT	0	6	40	20	2	28	2	15	20	-22.8	-40.0	148.6	-90.0	32.1
6	ORB SUNRISE	0	6	57	50	2	28	2	32	50	-23.1	32.8	148.5	-20.0	32.2
6	EFF SUNRISE	0	6	57	50	2	28	2	32	50	-23.1	32.8	148.5	-20.0	32.2
6	TERMIN RISE	0	7	2	49	2	28	2	37	50	-16.1	51.4	149.0	.0	32.2
7	ORBIT NOON	0	7	25	21	2	28	3	0	21	22.9	128.8	151.9	90.0	32.2

$SRSS$ MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORD		GET D	GET H	GET M	GET S	GMT MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
7	TERMIN SET	0	7	47	53	2	28	3	22	54	15.9	-139.9	151.5	-180.0	32.2
7	EFF SUNSET	0	7	52	56	2	28	3	27	56	7.1	-122.6	150.9	-159.9	32.2
7	ORB SUNSET	0	7	52	56	2	28	3	27	56	7.1	-122.6	150.9	-159.9	32.2
7	MIDNIGHT	0	8	10	24	2	28	3	45	25	-23.0	-62.4	148.6	-90.0	32.3
7	ORB SUNRISE	0	8	27	54	2	28	4	2	55	-22.9	10.3	148.5	-20.0	32.3
7	EFF SUNRISE	0	8	27	54	2	28	4	2	55	-22.9	10.3	148.5	-20.0	32.3
7	TERMIN RISE	0	8	32	54	2	28	4	7	54	-15.8	28.9	149.0	.0	32.3
8	ORBIT NOON	0	8	55	26	2	28	4	30	26	23.0	106.4	151.9	90.0	32.3
8	TERMIN SET	0	9	17	58	2	28	4	52	59	15.7	-162.3	151.5	180.0	32.3
8	EFF SUNSET	0	9	23	1	2	28	4	58	1	6.8	-145.1	150.9	-159.8	32.4
8	ORB SUNSET	0	9	23	1	2	28	4	58	1	6.8	-145.1	150.9	-159.8	32.4
8	MIDNIGHT	0	9	40	29	2	28	5	15	30	-23.1	-84.8	148.6	-90.0	32.4
8	ORB SUNRISE	0	9	57	59	2	28	5	32	59	-22.8	-12.1	148.5	-20.0	32.4
8	EFF SUNRISE	0	9	57	59	2	28	5	32	59	-22.8	-12.1	148.5	-20.0	32.4
8	TERMIN RISE	0	10	2	59	2	28	5	37	59	-15.6	6.4	149.0	-.0	32.4
9	ORBIT NOON	0	10	25	31	2	28	6	0	31	23.2	84.0	151.9	90.0	32.4
9	TERMIN SET	0	10	48	3	2	28	6	23	3	15.4	175.2	151.5	180.0	32.5
9	EFF SUNSET	0	10	53	6	2	28	6	28	7	6.5	-167.6	150.9	-159.8	32.5
9	ORB SUNSET	0	10	53	6	2	28	6	28	7	6.5	-167.6	150.9	-159.8	32.5
9	MIDNIGHT	0	11	10	34	2	28	6	45	34	-23.3	-107.2	148.6	-90.0	32.5
9	ORB SUNRISE	0	11	28	3	2	28	7	3	4	-22.6	-34.6	148.5	-20.0	32.5
9	EFF SUNRISE	0	11	28	3	2	28	7	3	4	-22.6	-34.6	148.5	-20.0	32.5
9	TERMIN RISE	0	11	33	4	2	28	7	8	4	-15.3	-16.1	149.0	.0	32.5
10	ORBIT NOON	0	11	55	35	2	28	7	30	36	23.4	61.5	151.9	90.0	32.6

$SRSS$ MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORB		GET D	H	M	S	GMT MO	D	H	M	S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
10	TERMIN SET	0	12	18	8	2	28	7	53	8	15.2	152.7	151.5	180.0	32.6
10	EFF SUNSET	0	12	23	12	2	28	7	58	12	6.2	169.9	150.9	-159.8	32.6
10	ORB SUNSET	0	12	23	12	2	28	7	58	12	6.2	169.9	150.9	-159.8	32.6
10	MIDNIGHT	0	12	40	39	2	28	8	15	39	-23.5	-129.7	148.6	-90.0	32.6
10	ORB SUNRISE	0	12	58	8	2	28	8	33	8	-22.4	-57.0	148.5	-20.1	32.6
10	EFF SUNRISE	0	12	58	8	2	28	8	33	8	-22.4	-57.0	148.5	-20.1	32.6
10	TERMIN RISE	0	13	3	9	2	28	8	38	9	-15.1	-38.5	149.0	-.0	32.6
11	ORBIT NOON	0	13	25	40	2	28	9	0	41	23.6	39.1	151.9	90.0	32.7
11	TERMIN SET	0	13	48	13	2	28	9	23	13	14.9	130.2	151.5	180.0	32.7
11	EFF SUNSET	0	13	53	17	2	28	9	28	17	5.9	147.4	150.9	-159.8	32.7
11	ORB SUNSET	0	13	53	17	2	28	9	28	17	5.9	147.4	150.9	-159.8	32.7
11	MIDNIGHT	0	14	10	44	2	28	9	45	44	-23.7	-152.1	148.6	-90.0	32.7
11	ORB SUNRISE	0	14	28	13	2	28	10	3	13	-22.2	-79.5	148.5	-20.1	32.7
11	EFF SUNRISE	0	14	28	13	2	28	10	3	13	-22.2	-79.5	148.5	-20.1	32.7
11	TERMIN RISE	0	14	33	14	2	28	10	8	14	-14.8	-61.0	149.0	.0	32.8
12	ORBIT NOON	0	14	55	45	2	28	10	30	46	23.7	16.7	151.9	90.0	32.8
12	TERMIN SET	0	15	18	18	2	28	10	53	18	14.7	107.7	151.5	180.0	32.8
12	EFF SUNSET	0	15	23	23	2	28	10	58	23	5.6	124.9	150.9	-159.7	32.8
12	ORB SUNSET	0	15	23	23	2	28	10	58	23	5.6	124.9	150.9	-159.7	32.8
12	MIDNIGHT	0	15	40	49	2	28	11	15	49	-23.8	-174.5	148.6	-90.0	32.8
12	ORB SUNRISE	0	15	58	17	2	28	11	33	17	-22.1	-101.9	148.5	-20.1	32.9
12	EFF SUNRISE	0	15	58	17	2	28	11	33	17	-22.1	-101.9	148.5	-20.1	32.9
12	TERMIN RISE	0	16	3	19	2	28	11	38	19	-14.6	-83.5	148.9	.0	32.9
13	ORBIT NOON	0	16	25	50	2	28	12	0	51	23.9	-5.7	151.9	90.0	32.9

SRSS MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORD		GET D	GET H	GET M	GET S	GMT MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
13	TERMIN SET	0	16	48	23	2	28	12	23	23	14.4	85.3	151.5	180.0	32.9
13	EFF SUNSET	0	16	53	28	2	28	12	28	28	5.3	102.4	150.9	-159.7	32.9
13	ORB SUNSET	0	16	53	28	2	28	12	28	28	5.3	102.4	150.9	-159.7	32.9
13	MIDNIGHT	0	17	10	54	2	28	12	45	54	-24.0	163.1	148.6	-90.0	32.9
13	ORB SUNRISE	0	17	28	22	2	28	13	3	22	-21.9	-124.4	148.5	-20.1	33.0
13	EFF SUNRISE	0	17	28	22	2	28	13	3	22	-21.9	-124.4	148.5	-20.1	33.0
13	TERMIN RISE	0	17	33	24	2	28	13	8	24	-14.3	-106.0	148.9	.0	33.0
14	ORBIT NOON	0	17	55	55	2	28	13	30	56	24.1	-28.1	151.9	90.0	33.0
14	TERMIN SET	0	18	18	28	2	28	13	53	28	14.2	62.8	151.5	-180.0	33.0
14	EFF SUNSET	0	18	23	33	2	28	13	58	33	5.0	79.9	150.8	-159.7	33.0
14	ORB SUNSET	0	18	23	33	2	28	13	58	33	5.0	79.9	150.8	-159.7	33.0
14	MIDNIGHT	0	18	40	59	2	28	14	15	59	-24.2	140.7	148.5	-90.0	33.1
14	ORB SUNRISE	0	18	58	26	2	28	14	33	27	-21.7	-146.8	148.4	-20.2	33.1
14	EFF SUNRISE	0	18	58	26	2	28	14	33	27	-21.7	-146.8	148.4	-20.2	33.1
14	TERMIN RISE	0	19	3	29	2	28	14	38	29	-14.0	-128.4	148.9	.0	33.1
15	ORBIT NOON	0	19	26	0	2	28	15	1	0	24.2	-50.5	151.8	90.0	33.1
15	TERMIN SET	0	19	48	33	2	28	15	23	33	13.9	40.3	151.5	180.0	33.1
15	EFF SUNSET	0	19	53	38	2	28	15	28	39	4.7	57.4	150.8	-159.7	33.1
15	ORB SUNSET	0	19	53	38	2	28	15	28	39	4.7	57.4	150.8	-159.7	33.1
15	MIDNIGHT	0	20	11	4	2	28	15	46	4	-24.3	118.3	148.5	-90.0	33.2
15	ORB SUNRISE	0	20	28	31	2	28	16	3	31	-21.5	-169.3	148.4	-20.2	33.2
15	EFF SUNRISE	0	20	28	31	2	28	16	3	31	-21.5	-169.3	148.4	-20.2	33.2
15	TERMIN RISE	0	20	33	34	2	28	16	8	34	-13.8	-150.9	148.9	.0	33.2
16	ORBIT NOON	0	20	56	5	2	28	16	31	5	24.4	-72.9	151.8	90.0	33.2

$SRSS$ MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORB		GET D	GET H	GET M	GET S	GMT MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
16	TERMIN SET	0	21	18	38	2	28	16	53	38	13.7	17.8	151.5	180.0	33.2
16	EFF SUNSET	0	21	23	44	2	28	16	58	44	4.4	35.0	150.8	-159.6	33.2
16	ORB SUNSET	0	21	23	44	2	28	16	58	44	4.4	35.0	150.8	-159.6	33.2
16	MIDNIGHT	0	21	41	9	2	28	17	16	9	-24.5	95.9	148.6	-90.0	33.3
16	ORB SUNRISE	0	21	58	35	2	28	17	33	35	-21.3	168.3	148.4	-20.2	33.3
16	EFF SUNRISE	0	21	58	35	2	28	17	33	35	-21.3	168.3	148.4	-20.2	33.3
16	TERMIN RISE	0	22	3	39	2	28	17	38	39	-13.5	-173.4	148.8	-.0	33.3
17	ORBIT NOON	0	22	26	10	2	28	18	1	10	24.6	-95.3	151.8	90.0	33.3
17	TERMIN SET	0	22	48	43	2	28	18	23	43	13.4	-4.7	151.5	180.0	33.3
17	EFF SUNSET	0	22	53	49	2	28	18	28	49	4.1	12.5	150.8	-159.6	33.3
17	ORB SUNSET	0	22	53	49	2	28	18	28	49	4.1	12.5	150.8	-159.6	33.3
17	MIDNIGHT	0	23	11	14	2	28	18	46	14	-24.6	73.5	148.6	-90.0	33.4
17	ORB SUNRISE	0	23	28	40	2	28	19	3	40	-21.1	145.8	148.4	-20.2	33.4
17	EFF SUNRISE	0	23	28	40	2	28	19	3	40	-21.1	145.8	148.4	-20.2	33.4
17	TERMIN RISE	0	23	33	44	2	28	19	8	44	-13.3	164.1	148.8	.0	33.4
18	ORBIT NOON	0	23	56	15	2	28	19	31	15	24.7	-117.7	151.8	90.0	33.4
18	TERMIN SET	1	0	18	48	2	28	19	53	48	13.1	-27.1	151.5	-180.0	33.4
18	EFF SUNSET	1	0	23	54	2	28	19	58	54	3.8	-10.0	150.8	-159.6	33.4
18	ORB SUNSET	1	0	23	54	2	28	19	58	54	3.8	-10.0	150.8	-159.6	33.4
18	MIDNIGHT	1	0	41	19	2	28	20	16	19	-24.8	51.1	148.6	-90.0	33.5
18	ORB SUNRISE	1	0	58	45	2	28	20	33	45	-20.9	123.4	148.4	-20.3	33.5
18	EFF SUNRISE	1	0	58	45	2	28	20	33	45	-20.9	123.4	148.4	-20.3	33.5
18	TERMIN RISE	1	1	3	49	2	28	20	38	49	-13.0	141.6	148.8	-.0	33.5
19	ORBIT NOON	1	1	26	20	2	28	21	1	20	24.9	-140.1	151.8	90.0	33.5

$SRSS$ MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORB		GET D	GET H	GET M	GET S	GMT MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
19	TERMIN SET	1	1	48	53	2	28	21	23	53	12.9	-49.6	151.5	-180.0	33.5
19	EFF SUNSET	1	1	53	60	2	28	21	28	60	3.5	-32.5	150.8	-159.6	33.5
19	ORB SUNSET	1	1	53	60	2	28	21	28	60	3.5	-32.5	150.8	-159.6	33.5
19	MIDNIGHT	1	2	11	24	2	28	21	46	24	-24.9	28.7	148.6	-90.0	33.6
19	ORB SUNRISE	1	2	28	49	2	28	22	3	49	-20.7	100.9	148.4	-20.3	33.6
19	EFF SUNRISE	1	2	28	49	2	28	22	3	49	-20.7	100.9	148.4	-20.3	33.6
19	TERMIN RISE	1	2	33	53	2	28	22	8	54	-12.7	119.2	148.8	.0	33.6
20	ORBIT NOON	1	2	56	25	2	28	22	31	25	25.0	-162.5	151.8	90.0	33.6
20	TERMIN SET	1	3	18	57	2	28	22	53	58	12.6	-72.1	151.5	180.0	33.6
20	EFF SUNSET	1	3	24	5	2	28	22	59	5	3.2	-55.0	150.8	-159.5	33.6
20	ORB SUNSET	1	3	24	5	2	28	22	59	5	3.2	-55.0	150.8	-159.5	33.6
20	MIDNIGHT	1	3	41	29	2	28	23	16	29	-25.1	6.3	148.6	-90.0	33.7
20	ORB SUNRISE	1	3	58	54	2	28	23	33	54	-20.5	78.5	148.4	-20.3	33.7
20	EFF SUNRISE	1	3	58	54	2	28	23	33	54	-20.5	78.5	148.4	-20.3	33.7
20	TERMIN RISE	1	4	3	58	2	28	23	38	59	-12.5	96.7	148.8	.0	33.7
21	ORBIT NOON	1	4	26	30	3	1	0	1	30	25.2	175.1	151.8	90.0	33.7
21	TERMIN SET	1	4	49	2	3	1	0	24	3	12.3	-94.6	151.5	180.0	33.7
21	EFF SUNSET	1	4	54	10	3	1	0	29	10	2.9	-77.5	150.9	-159.5	33.7
21	ORB SUNSET	1	4	54	10	3	1	0	29	10	2.9	-77.5	150.9	-159.5	33.7
21	MIDNIGHT	1	5	11	34	3	1	0	46	34	-25.2	-16.1	148.6	-90.0	33.7
21	ORB SUNRISE	1	5	28	58	3	1	1	3	59	-20.3	56.0	148.4	-20.3	33.8
21	EFF SUNRISE	1	5	28	58	3	1	1	3	59	-20.3	56.0	148.4	-20.3	33.8
21	TERMIN RISE	1	5	34	3	3	1	1	9	4	-12.2	74.2	148.8	.0	33.8
22	ORBIT NOON	1	5	56	35	3	1	1	31	35	25.3	152.7	151.8	90.0	33.8

SRSS MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORB		GET D	GET H	GET M	GET S	MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
22	TERMIN SET	1	6	19	7	3	1	1	54	8	12.0	-117.1	151.4	180.0	33.8
22	EFF SUNSET	1	6	24	15	3	1	1	59	16	2.6	-100.0	150.8	-159.5	33.8
22	ORB SUNSET	1	6	24	15	3	1	1	59	16	2.6	-100.0	150.8	-159.5	33.8
22	MIDNIGHT	1	6	41	38	3	1	2	16	39	-25.4	-38.4	148.5	-90.0	33.8
22	ORB SUNRISE	1	6	59	3	3	1	2	34	3	-20.1	33.6	148.3	-20.3	33.8
22	EFF SUNRISE	1	6	59	3	3	1	2	34	3	-20.1	33.6	148.3	-20.3	33.8
22	TERMIN RISE	1	7	4	8	3	1	2	39	8	-11.9	51.7	148.7	.0	33.8
23	ORBIT NOON	1	7	26	39	3	1	3	1	40	25.5	130.4	151.7	90.0	33.9
23	TERMIN SET	1	7	49	12	3	1	3	24	12	11.8	-139.5	151.4	-180.0	33.9
23	EFF SUNSET	1	7	54	20	3	1	3	29	21	2.3	-122.4	150.8	-159.5	33.9
23	ORB SUNSET	1	7	54	20	3	1	3	29	21	2.3	-122.4	150.8	-159.5	33.9
23	MIDNIGHT	1	8	11	43	3	1	3	46	43	-25.5	-60.8	148.5	-90.0	33.9
23	ORB SUNRISE	1	8	29	7	3	1	4	4	8	-19.8	11.1	148.3	-20.4	33.9
23	EFF SUNRISE	1	8	29	7	3	1	4	4	8	-19.8	11.1	148.3	-20.4	33.9
23	TERMIN RISE	1	8	34	13	3	1	4	9	13	-11.6	29.2	148.7	.0	33.9
24	ORBIT NOON	1	8	56	44	3	1	4	31	45	25.6	108.0	151.7	90.0	34.0
24	TERMIN SET	1	9	19	17	3	1	4	54	17	11.5	-162.0	151.4	-180.0	34.0
24	EFF SUNSET	1	9	24	26	3	1	4	59	26	2.0	-144.9	150.8	-159.5	34.0
24	ORB SUNSET	1	9	24	26	3	1	4	59	26	2.0	-144.9	150.8	-159.5	34.0
24	MIDNIGHT	1	9	41	48	3	1	5	16	48	-25.7	-83.2	148.5	-90.0	34.0
24	ORB SUNRISE	1	9	59	12	3	1	5	34	12	-19.6	-11.3	148.3	-20.4	34.0
24	EFF SUNRISE	1	9	59	12	3	1	5	34	12	-19.6	-11.3	148.3	-20.4	34.0
24	TERMIN RISE	1	10	4	18	3	1	5	39	18	-11.4	6.8	148.7	.0	34.0
25	ORBIT NOON	1	10	26	49	3	1	6	1	49	25.7	85.6	151.7	90.0	34.0

$SRSS$ MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORB		GET D	GET H	GET M	GET S	MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
25	TERMIN SET	1	10	49	22	3	1	6	24	22	11.2	175.5	151.4	180.0	34.1
25	EFF SUNSET	1	10	54	31	3	1	6	29	31	1.7	-167.4	150.8	-159.4	34.1
25	ORB SUNSET	1	10	54	31	3	1	6	29	31	1.7	-167.4	150.8	-159.4	34.1
25	MIDNIGHT	1	11	11	53	3	1	6	46	53	-25.8	-105.6	148.5	-90.0	34.1
25	ORB SUNRISE	1	11	29	17	3	1	7	4	17	-19.4	-33.2	148.3	-20.4	34.1
25	EFF SUNRISE	1	11	29	17	3	1	7	4	17	-19.4	-33.2	148.3	-20.4	34.1
25	TERMIN RISE	1	11	34	23	3	1	7	9	23	-11.1	-15.7	148.7	.0	34.1
26	ORBIT NOON	1	11	56	54	3	1	7	31	54	25.9	63.2	151.7	90.0	34.1
26	TERMIN SET	1	12	19	27	3	1	7	54	27	10.9	153.0	151.4	180.0	34.1
26	EFF SUNSET	1	12	24	36	3	1	7	59	36	1.4	170.1	150.8	-159.4	34.1
26	ORB SUNSET	1	12	24	36	3	1	7	59	36	1.4	170.1	150.8	-159.4	34.1
26	MIDNIGHT	1	12	41	58	3	1	8	16	58	-25.9	-127.9	148.5	-90.0	34.2
26	ORB SUNRISE	1	12	59	21	3	1	8	34	21	-19.2	-56.2	148.3	-20.4	34.2
26	EFF SUNRISE	1	12	59	21	3	1	8	34	21	-19.2	-56.2	148.3	-20.4	34.2
26	TERMIN RISE	1	13	4	28	3	1	8	39	28	-10.8	-38.2	148.7	.0	34.2
27	ORBIT NOON	1	13	26	59	3	1	9	1	59	26.0	40.9	151.7	90.0	34.2
27	TERMIN SET	1	13	49	32	3	1	9	24	32	10.7	130.5	151.4	-180.0	34.2
27	EFF SUNSET	1	13	54	41	3	1	9	29	41	1.0	147.6	150.8	-159.4	34.2
27	ORB SUNSET	1	13	54	41	3	1	9	29	41	1.0	147.6	150.8	-159.4	34.2
27	MIDNIGHT	1	14	12	3	3	1	9	47	3	-26.1	-150.3	148.5	-90.0	34.2
27	ORB SUNRISE	1	14	29	26	3	1	10	4	26	-19.0	-78.7	148.3	-20.4	34.2
27	EFF SUNRISE	1	14	29	26	3	1	10	4	26	-19.0	-78.7	148.3	-20.4	34.2
27	TERMIN RISE	1	14	34	33	3	1	10	9	33	-10.5	-60.7	148.7	.0	34.3
28	ORBIT NOON	1	14	57	4	3	1	10	32	4	26.1	18.5	151.7	90.0	34.3

SRSS MAXIMUM LINE NUMBER<

TABLE VIII.- CONTINUED.

ORB		GET D	GET H	GET M	GET S	MO	GMT D	GMT H	GMT M	GMT S	LAT	LON	ALT	LVLH PITCH	LVLH YAW
28	TERMIN SET	1	15	19	36	3	1	10	54	37	10.4	108.1	151.4	-180.0	34.3
28	EFF SUNSET	1	15	24	46	3	1	10	59	47	.7	125.1	150.8	-159.4	34.3
28	ORB SUNSET	1	15	24	46	3	1	10	59	47	.7	125.1	150.8	-159.4	34.3
28	MIDNIGHT	1	15	42	8	3	1	11	17	8	-26.2	-172.7	148.5	-90.0	34.3
28	ORB SUNRISE	1	15	59	30	3	1	11	34	31	-18.7	-101.1	148.3	-20.5	34.3
28	EFF SUNRISE	1	15	59	30	3	1	11	34	31	-18.7	-101.1	148.3	-20.5	34.3
28	TERMIN RISE	1	16	4	37	3	1	11	39	38	-10.2	-83.2	148.7	-.0	34.3
29	ORBIT NOON	1	16	27	9	3	1	12	2	9	26.3	-3.9	151.6	90.0	34.3
29	TERMIN SET	1	16	49	41	3	1	12	24	42	10.1	85.6	151.4	180.0	34.4
29	EFF SUNSET	1	16	54	52	3	1	12	29	52	.4	102.6	150.8	-159.4	34.4
29	ORB SUNSET	1	16	54	52	3	1	12	29	52	.4	102.6	150.8	-159.4	34.4
29	MIDNIGHT	1	17	12	13	3	1	12	47	13	-26.3	165.0	148.5	-90.0	34.4
29	ORB SUNRISE	1	17	29	35	3	1	13	4	35	-18.5	-123.6	148.3	-20.5	34.4
29	EFF SUNRISE	1	17	29	35	3	1	13	4	35	-18.5	-123.6	148.3	-20.5	34.4
29	TERMIN RISE	1	17	34	42	3	1	13	9	43	-9.9	-105.6	148.6	-.0	34.4
30	ORBIT NOON	1	17	57	14	3	1	13	32	14	26.4	-26.2	151.6	90.0	34.4
30	TERMIN SET	1	18	19	46	3	1	13	54	46	9.8	63.1	151.4	180.0	34.4
30	EFF SUNSET	1	18	24	56	3	1	13	59	57	.1	80.2	150.7	-159.3	34.4
30	ORB SUNSET	1	18	24	56	3	1	13	59	57	.1	80.2	150.7	-159.3	34.4
30	MIDNIGHT	1	18	42	17	3	1	14	17	18	-26.4	142.6	148.4	-90.0	34.4
30	ORB SUNRISE	1	18	59	40	3	1	14	34	40	-18.3	-146.0	148.2	-20.5	34.5
30	EFF SUNRISE	1	18	59	40	3	1	14	34	40	-18.3	-146.0	148.2	-20.5	34.5
30	TERMIN RISE	1	19	4	47	3	1	14	39	47	-9.7	-128.1	148.6	-.0	34.5
31	ORBIT NOON	1	19	27	18	3	1	15	2	19	26.5	-48.6	151.6	90.0	34.5

SRSS MAXIMUM LINE NUMBER<

TABLE VIII.- CONCLUDED.

		GET					GMT							LULH	LULH
ORB		D	H	M	S	MO	D	H	M	S	LAT	LON	ALT	PITCH	YAW
31	TERMIN SET	1	19	49	51	3	1	15	24	51	9.5	40.6	151.4	-180.0	34.5
31	EFF SUNSET	1	19	55	2	3	1	15	30	2	-.2	57.7	150.7	-159.3	34.5
31	ORB SUNSET	1	19	55	2	3	1	15	30	2	-.2	57.7	150.7	-159.3	34.5
31	MIDNIGHT	1	20	12	22	3	1	15	47	22	-26.6	120.2	148.4	-90.0	34.5
31	ORB SUNRISE	1	20	29	44	3	1	16	4	44	-18.0	-168.5	148.2	-20.5	34.5
31	EFF SUNRISE	1	20	29	44	3	1	16	4	44	-18.0	-168.5	148.2	-20.5	34.5
31	TERMIN RISE	1	20	34	52	3	1	16	9	52	-9.4	-150.8	148.6	.0	34.5
32	ORBIT NOON	1	20	57	23	3	1	16	32	23	26.6	-70.9	151.6	90.0	34.5
32	TERMIN SET	1	21	19	56	3	1	16	54	56	9.2	18.1	151.4	180.0	34.6
32	EFF SUNSET	1	21	25	7	3	1	17	0	7	-.5	35.2	150.7	-159.3	34.6
32	ORB SUNSET	1	21	25	7	3	1	17	0	7	-.5	35.2	150.7	-159.3	34.6
32	MIDNIGHT	1	21	42	27	3	1	17	17	27	-26.7	97.9	148.4	-90.0	34.6
32	ORB SUNRISE	1	21	59	49	3	1	17	34	49	-17.8	169.1	148.2	-20.5	34.6
32	EFF SUNRISE	1	21	59	49	3	1	17	34	49	-17.8	169.1	148.2	-20.5	34.6
32	TERMIN RISE	1	22	4	57	3	1	17	39	57	-9.1	-173.1	148.6	.0	34.6
33	ORBIT NOON	1	22	27	28	3	1	18	2	28	26.7	-93.3	151.5	90.0	34.6

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TABLE IX.- FLIGHT 7 NONPROPULSIVE CONSUMABLES LOADING

System	Weight, lb
GO2	66.0
GN2	212.0
Potable H_2O	578.3
Waste H_2O	160.0
NH_3	97.6
Cryogenic O_2	1574.0
Cryogenic H_2	186.0
APU N_2H_4	1050.0
Hydraulic H_2O	428.4
Pressurants	533.0
Total	4885.3

TABLE X.- FLIGHT 7 PROPULSIVE CONSUMABLES LOADING

(a) Minimum RCS propellant budget

Propellant usage, lb	Forward	After	Total
ET sep (4 fps)	57.2	114.5	171.7
Orbit trim maneuvers (15 fps)	4.5	406.3	410.8
PL sep (3.0 fps)	96.9	75.5	172.4
Additional prop for ascending node PL sep	47.0	69.0	116.0
Attitude maneuvers	425.3	956.5	1381.8
Deorbit maneuvers	0.0	1181.2	1181.2
Total usable required	630.9	2803.0	3433.9
Trapped, display and control	492.0	942.0	1434.0
Total required	1122.9	3745.0	4867.9
Total load	1601.0	3760.0	5361.0
Margin[a]	478.1	15.0	493.1

[a]Maximum RCS load available = 7508 pounds.

TABLE X.- Continued

(b) OMS propellant budget

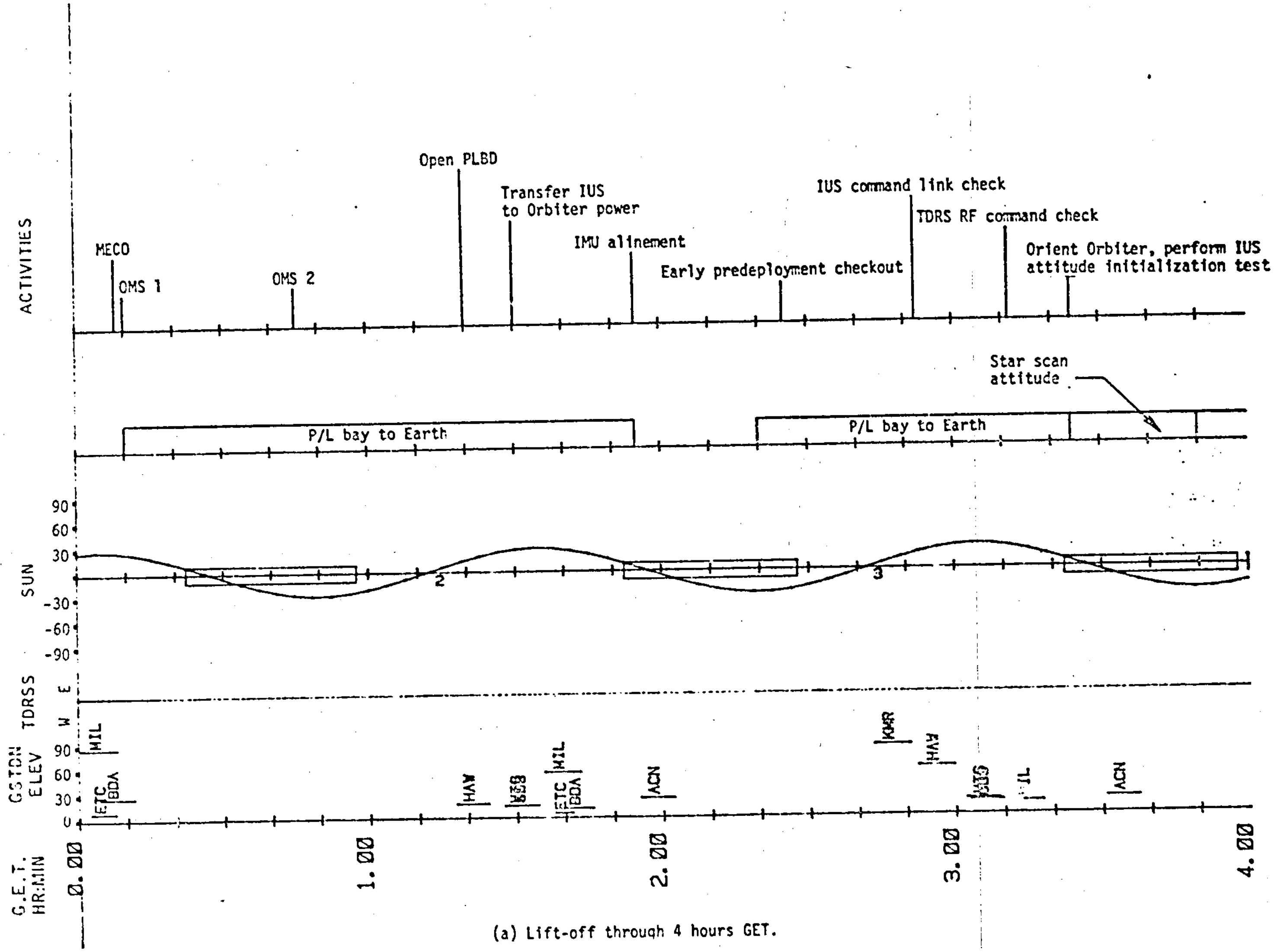
	Case I (Mission with payload at landing)				Case II (Mission without payload at landing)			
	ΔV, fps	Oxidizer, lb	Fuel, lb	Total, lb	ΔV, fps	Oxidizer, lb	Fuel, lb	Total, lb
Insertion	211	3 245	1967	5 212	211	3 245	1967	5 212
Onorbit	169	2 495	1512	4 006	238	3 319	2012	5 331
Deorbit	297	4 236	2568	6 804	273	3 185	1931	5 116
Total usable required	677	9 976	6047	16 022	722	9 749	5910	15 659
Total display and control		454	312	766		452	306	758
Total trapped		584	307	891		584	307	891
Total required		11 014	6665	17 679		10 785	6522	17 307
Total load		11 021	6679	17 700		11 021	6679	17 700

TABLE X.- Concluded

(c) Orbiter mass properties during the mission

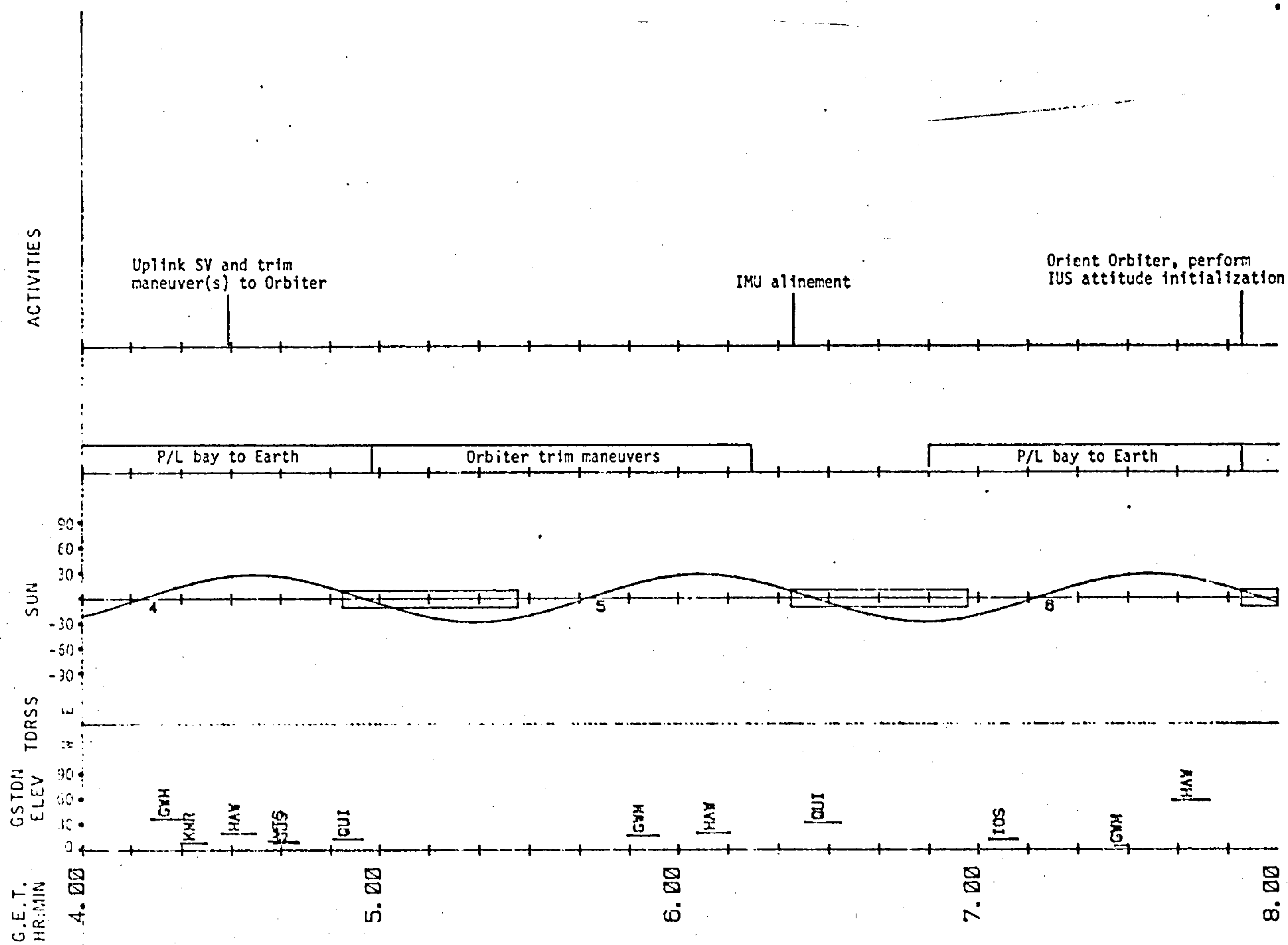
	Case I (Mission with payload at landing)				Case II (Mission without payload at landing)			
	Weight, lb	X_{cg}, in.	Y_{cg}, in.	Z_{cg}, in.	Weight, lb	X_{cg}, in.	Y_{cg}, in.	Z_{cg}, in.
Lift-off	251 908.6	1119.4	-0.2	382.8	251 908.6	1119.4	-0.2	282.8
OP CMS-1	251 550.8	1119.4	-.2	382.8	251 550.8	1119.4	-0.2	382.8
OA CMS-1	246 338.3	1113.3	-.2	380.8	246 338.3	1113.3	-0.2	380.8
OP CMS-2	240 928.3	1107.0	-.3	381.4	240 928.3	1107.0	-0.3	381.4
OA CMS-2	236 921.4	1101.7	-.3	379.8	236 921.4	1101.7	-0.3	379.8
OP PL deployment					235 485.6	1101.7	-0.4	379.4
OA PL release					194 140.6	1113.1	0.0	376.3
OP PL sep burn					193 999.7	1113.5	0.0	376.2
OA PL sep burn					192 675.9	1111.3	0.0	375.6
OP deorbit burn	234 261.8	1102.4	-0.3	379.5	191 400.4	1112.2	0.0	375.5
OA deorbit burn	227 458.1	1092.2	-0.3	376.6	186 284.6	1103.1	0.0	372.8
Entry interface	225 804.7	1090.7	-0.3	376.0	184 631.2	1101.3	0.0	372.1

OP = Orbiter prior.
OA = Orbiter after.



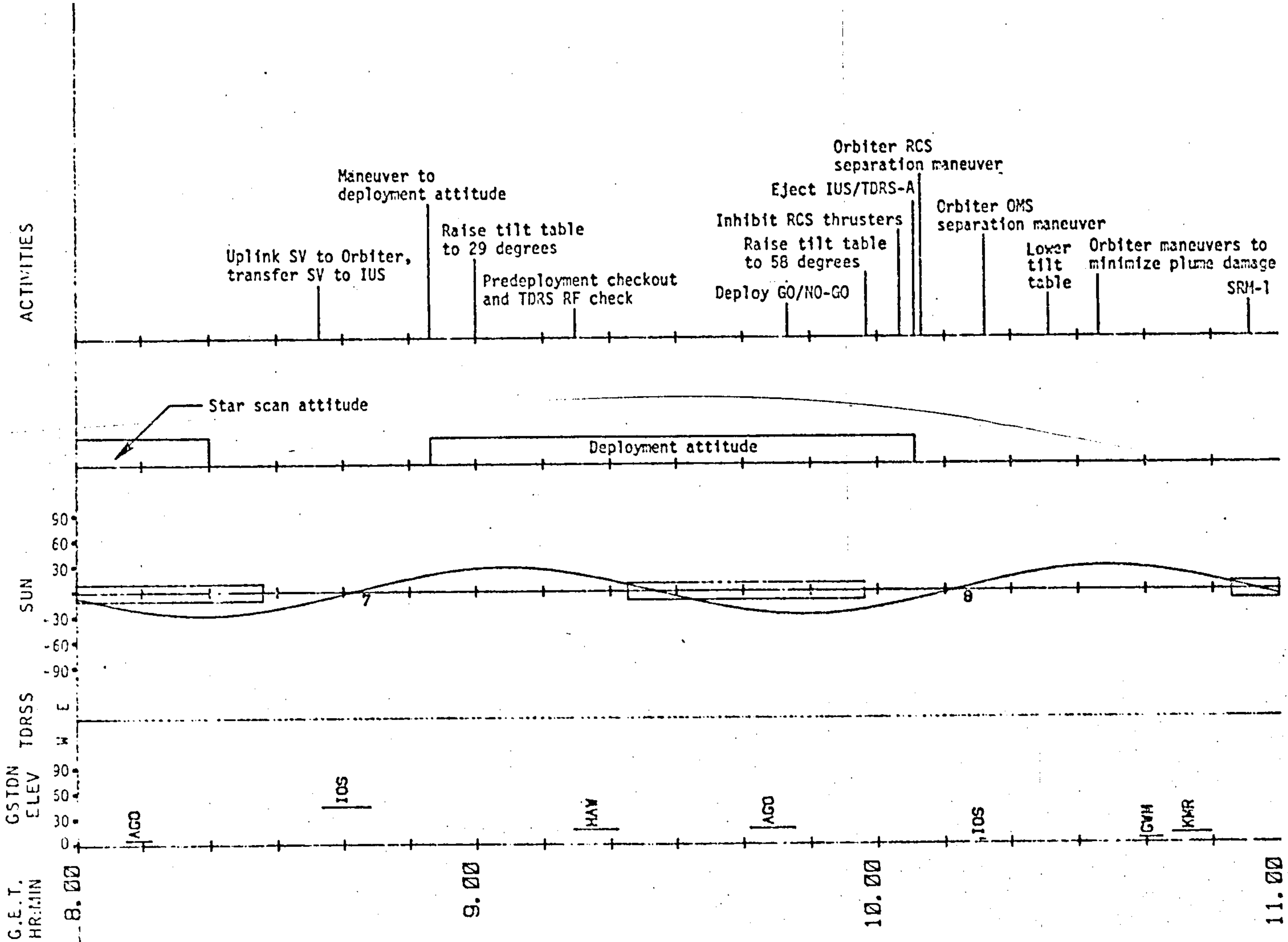
(a) Lift-off through 4 hours GET.

Figure 1.- Flight 7 activities time line.



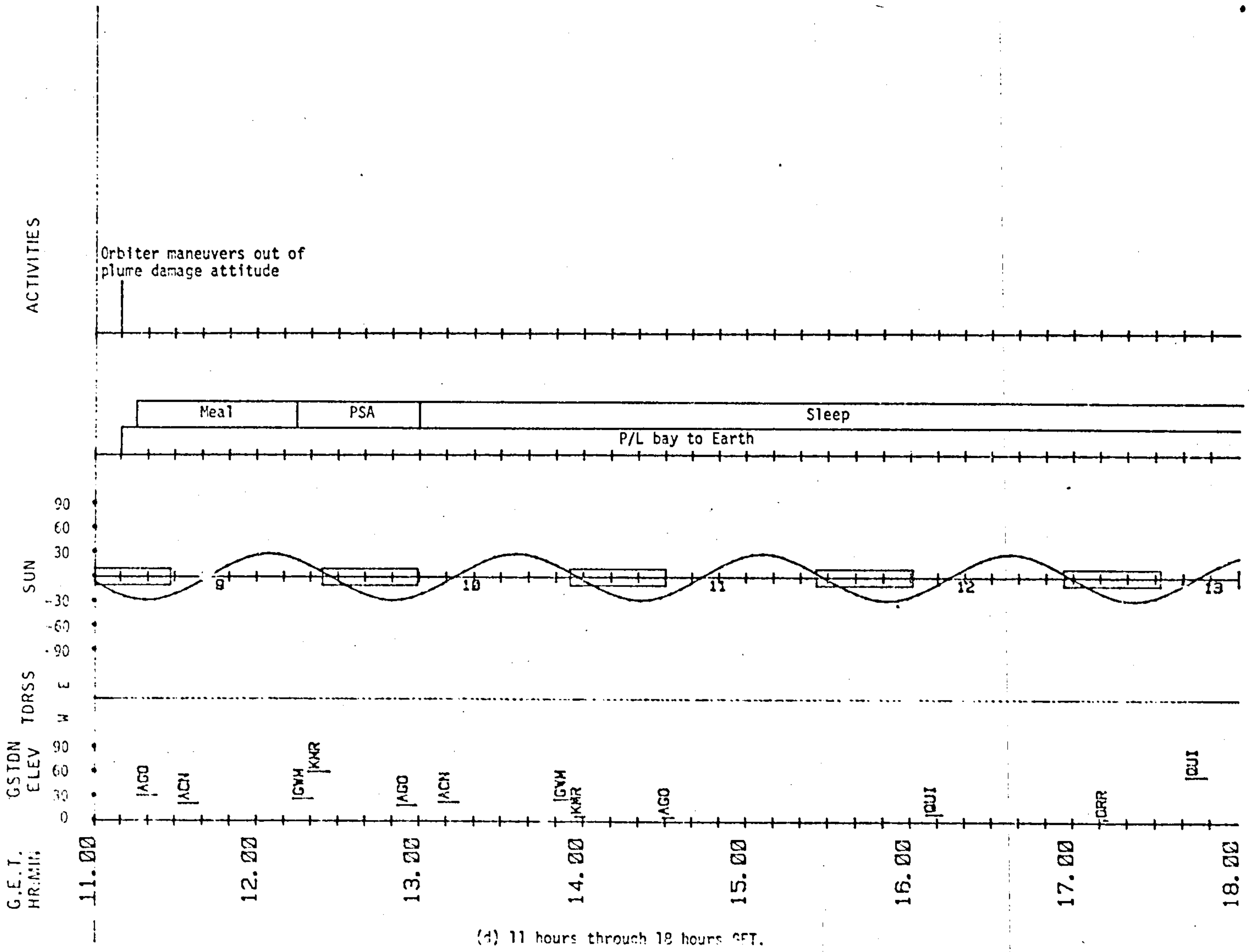
(b) 4 hours through 8 hours GET.

Figure 1.- Continued.



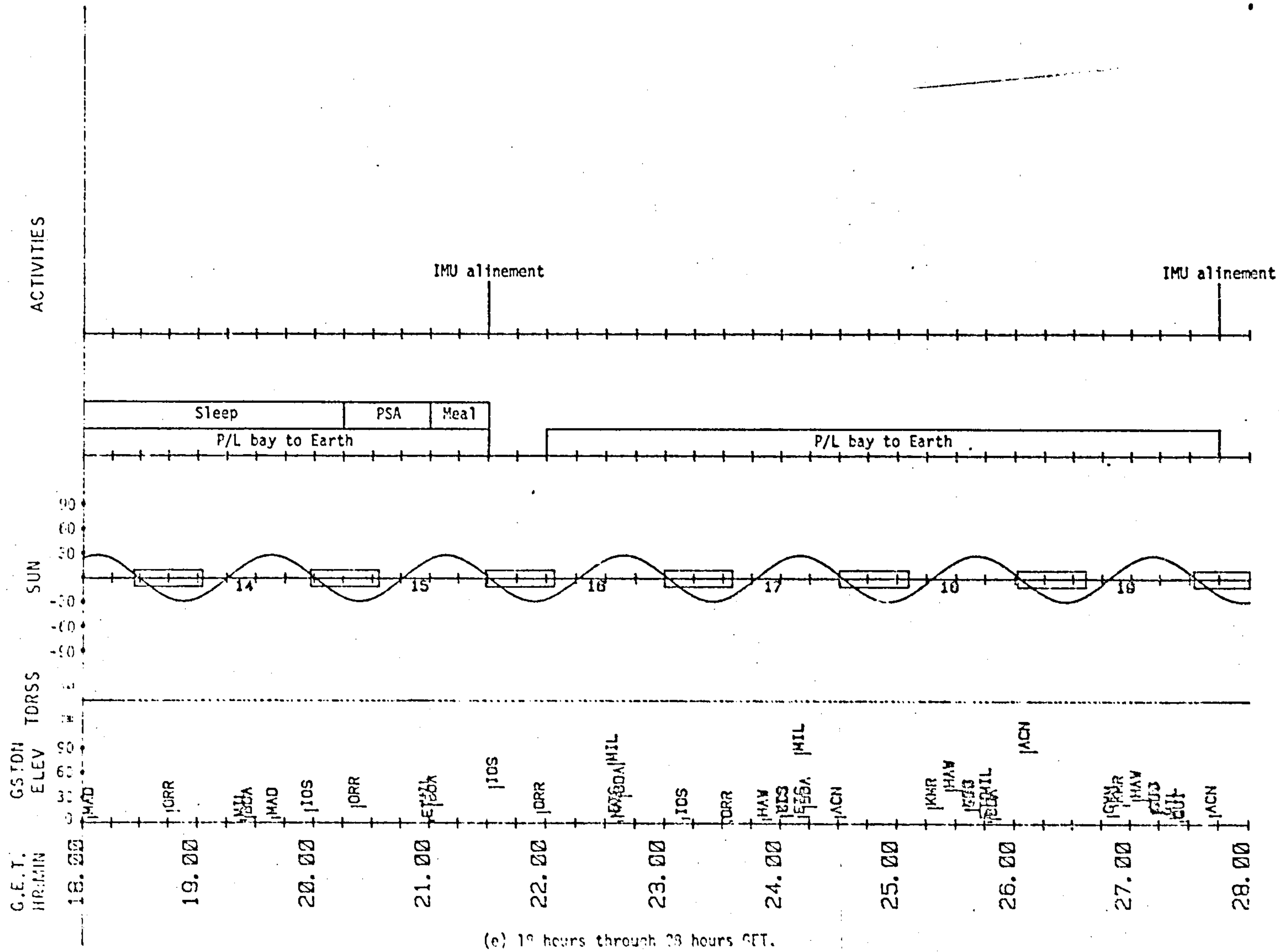
(c) 8 hours through 11 hours GET.

Figure 1.- Continued.



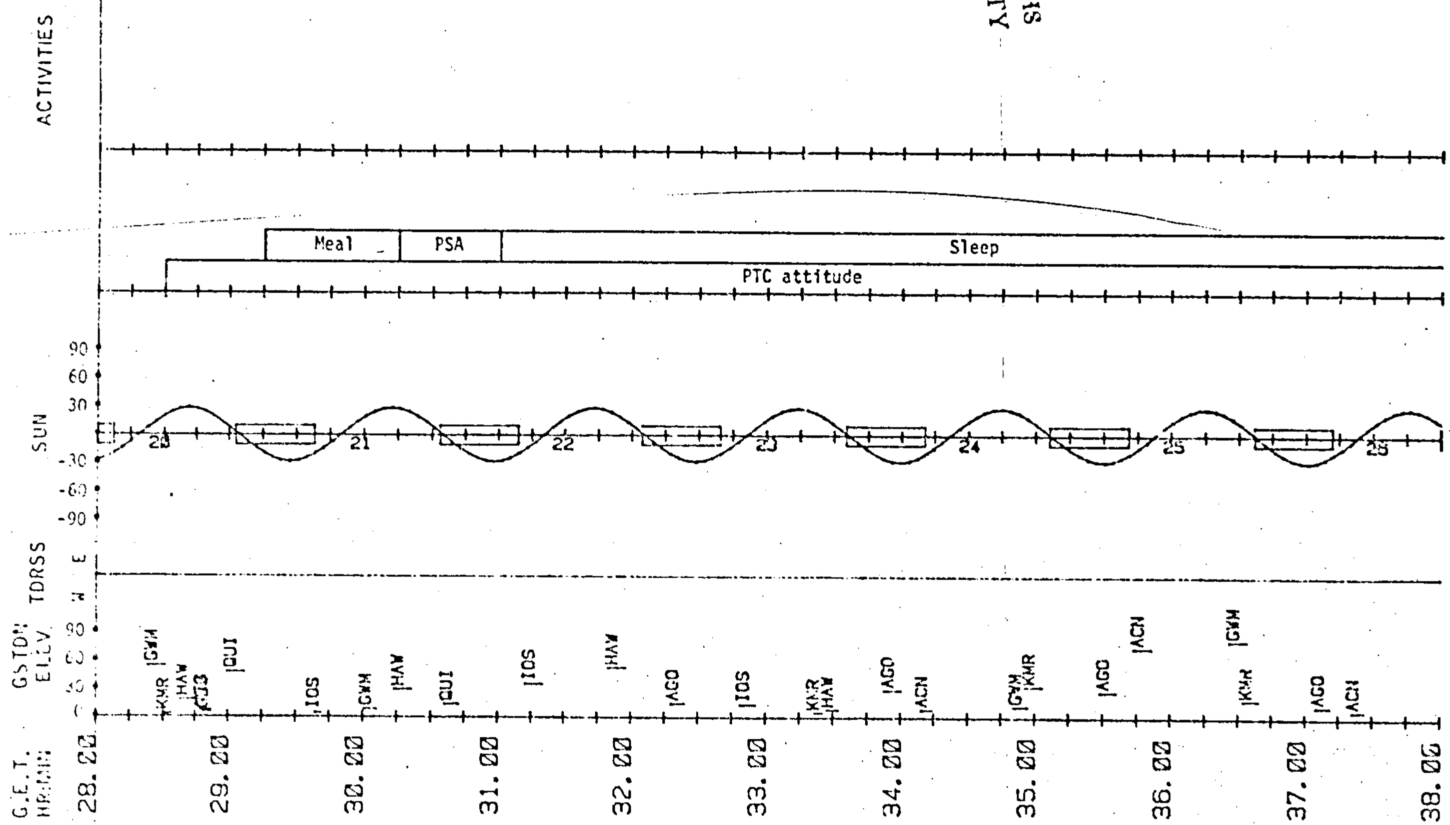
(d) 11 hours through 18 hours GET.

Figure 1.- Continued.



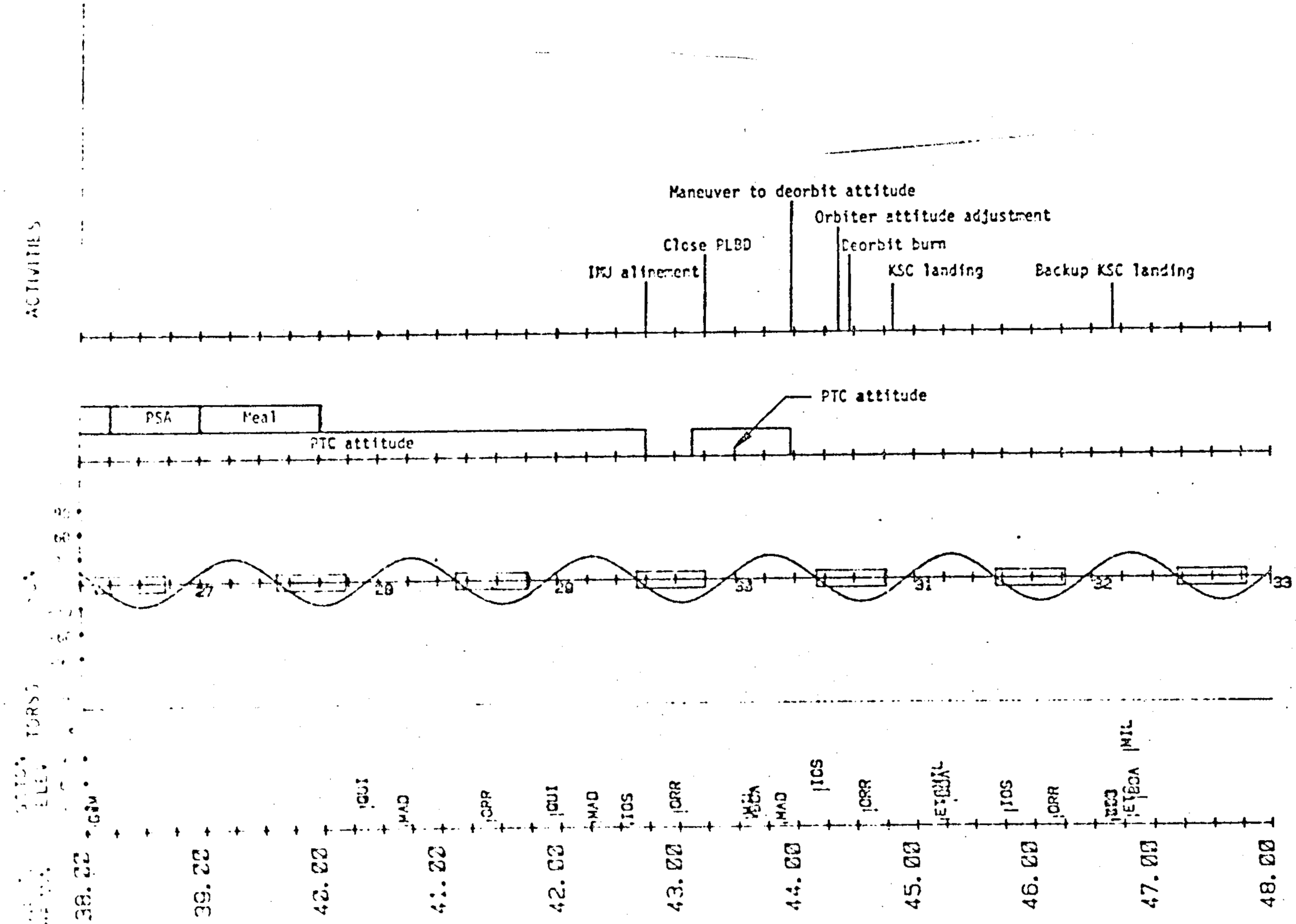
(c) 18 hours through 28 hours GET.

Figure 1.- Continued.

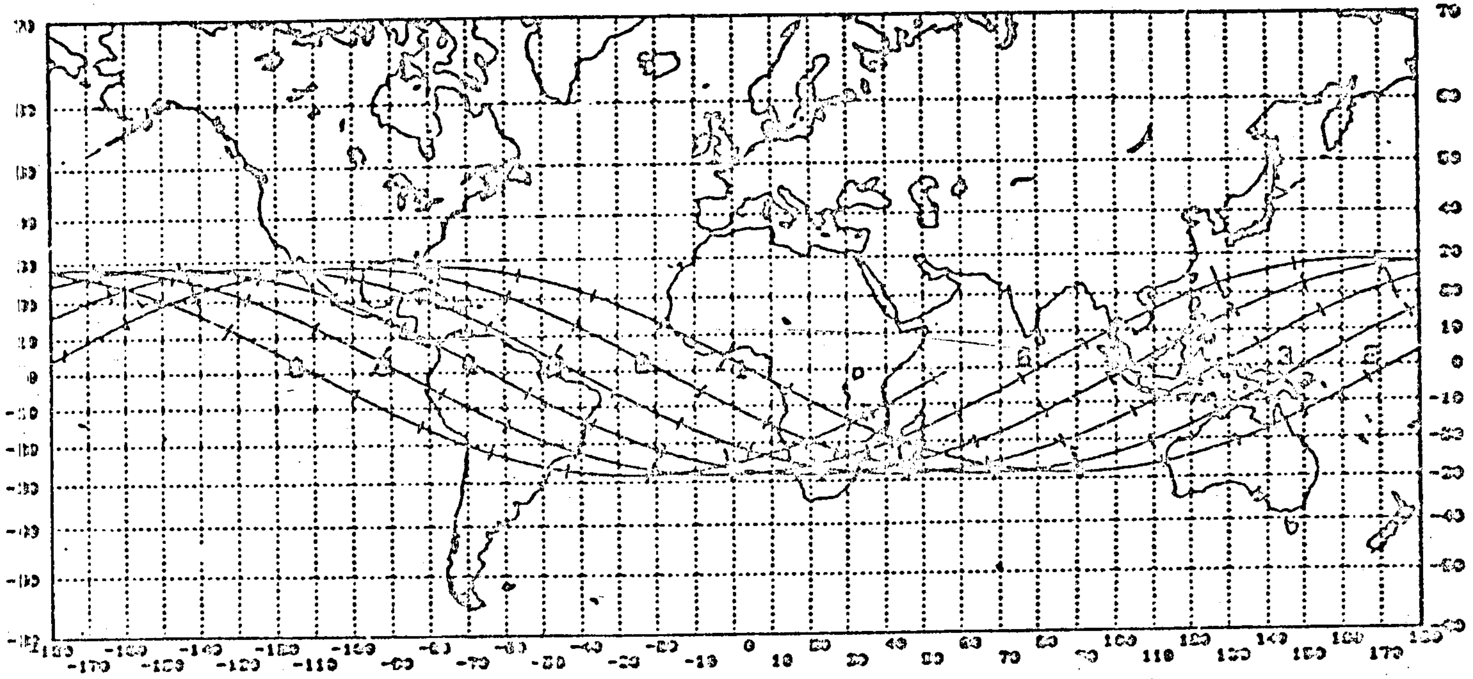


(f) 28 hours through 38 hours GET.

Figure 1.- Continued.

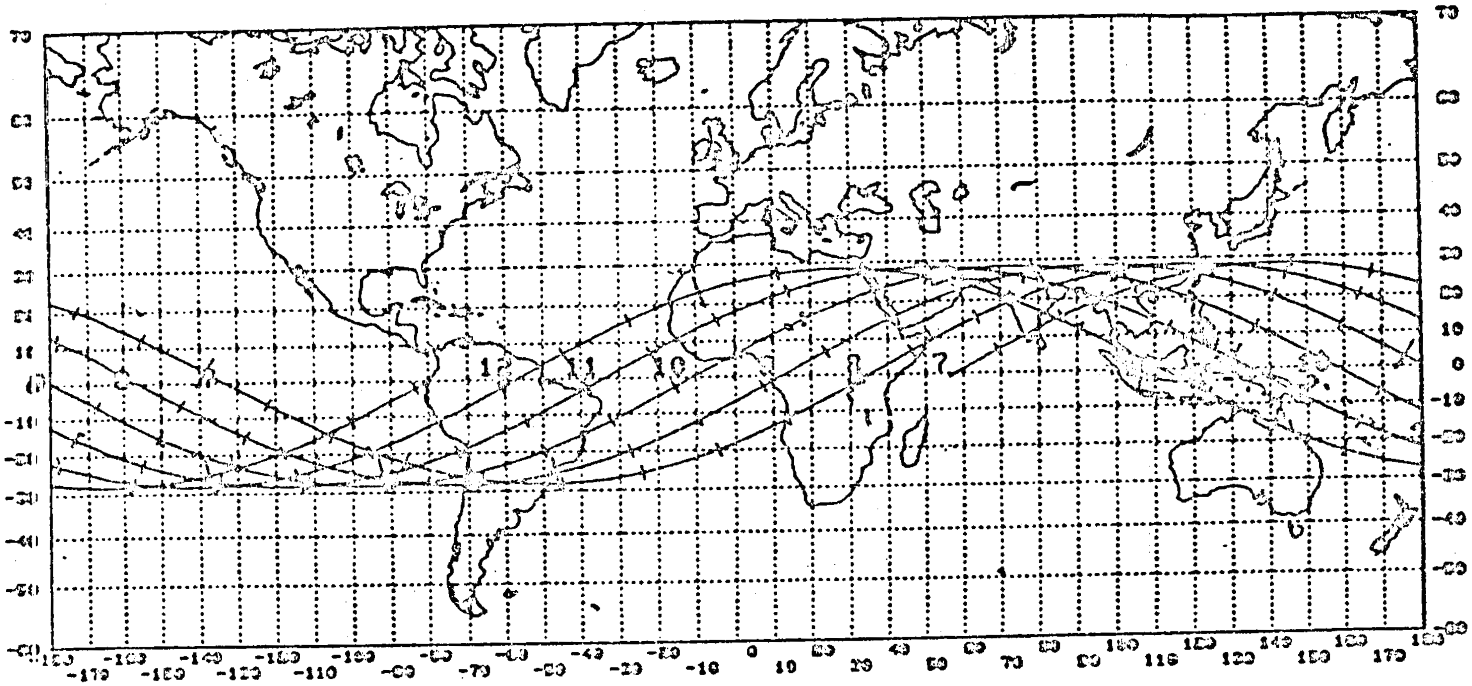


ACTIVITIES
Maneuver to deorbit attitude
Orbiter attitude adjustment
Close PLBD
Deorbit burn
IMU alinement
KSC landing
Backup KSC landing
PSA
Meal
PTC attitude
PTC attitude
27
28
29
30
31
32
33
38.00
39.00
40.00
41.00
42.00
43.00
44.00
45.00
46.00
47.00
48.00



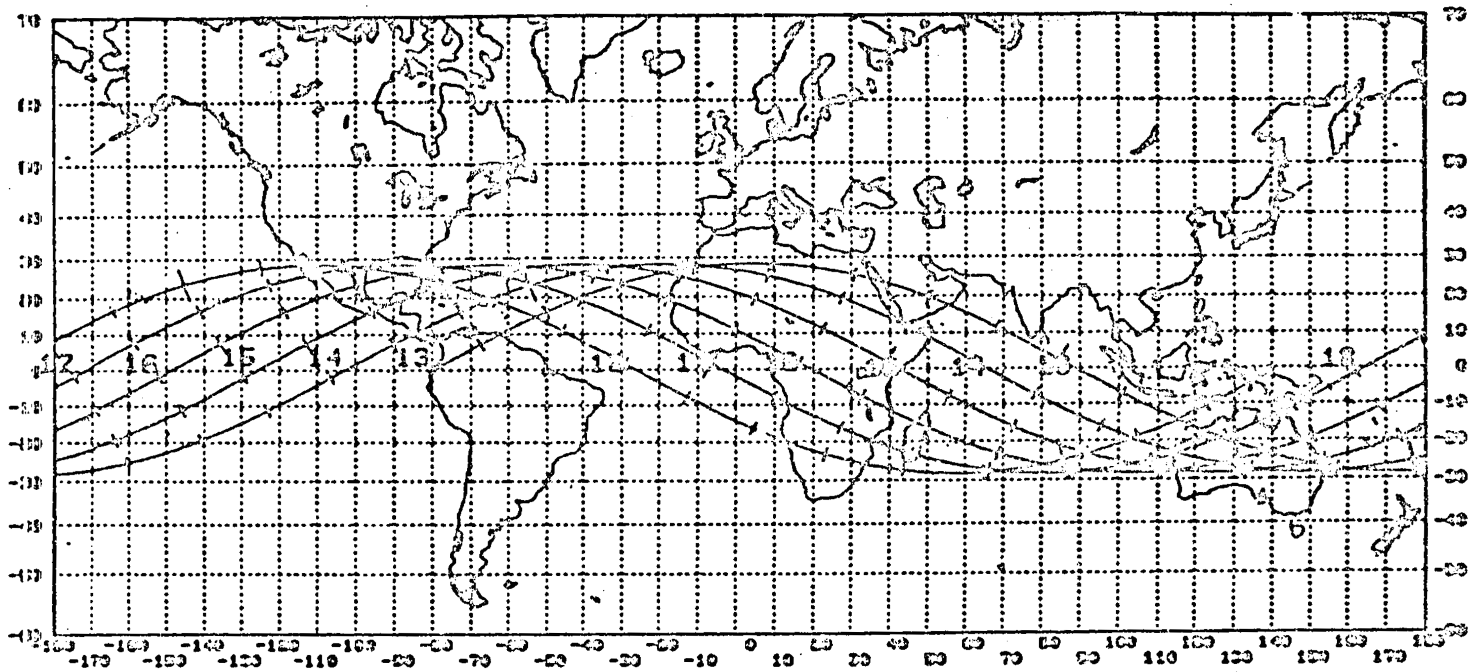
(a) Lift-off through orbit 6.

Figure 2.- Orbiter groundtracks



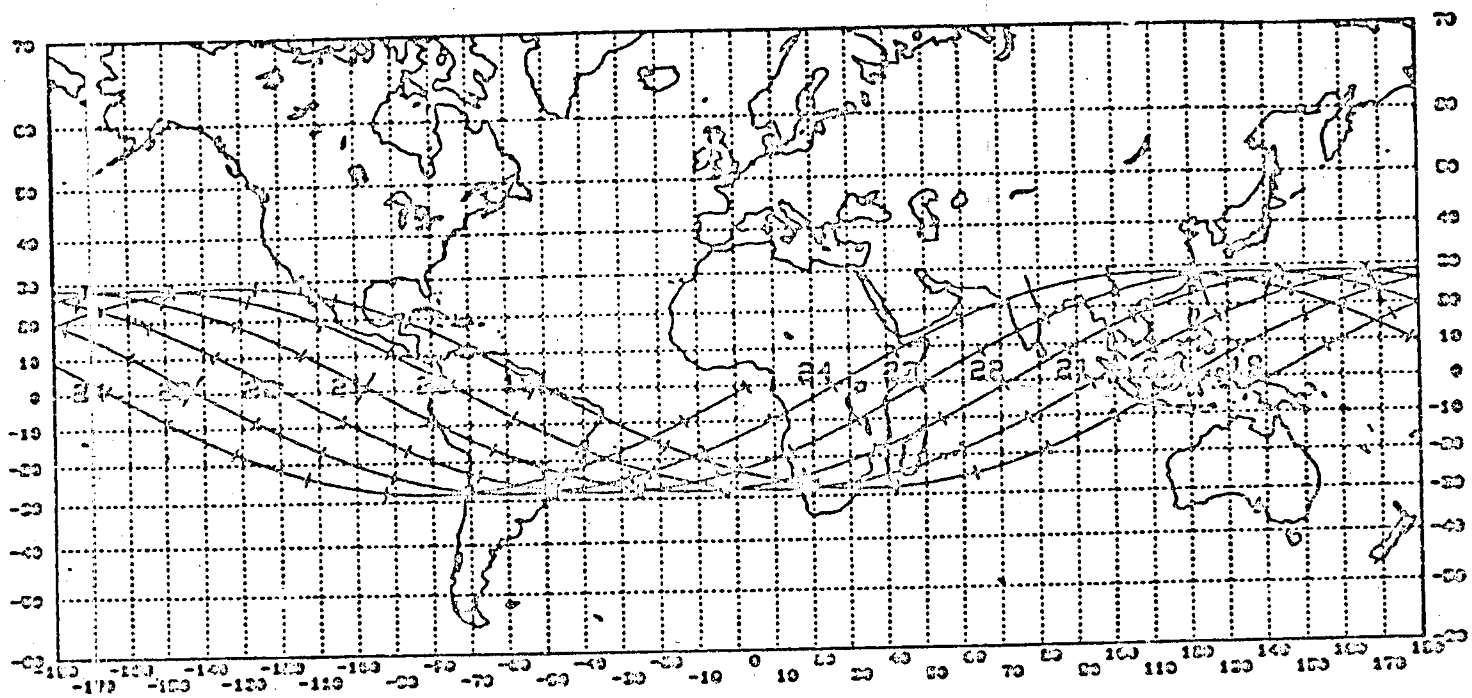
(b) Orbit 6 through orbit 12.

Figure 2.- Continued.



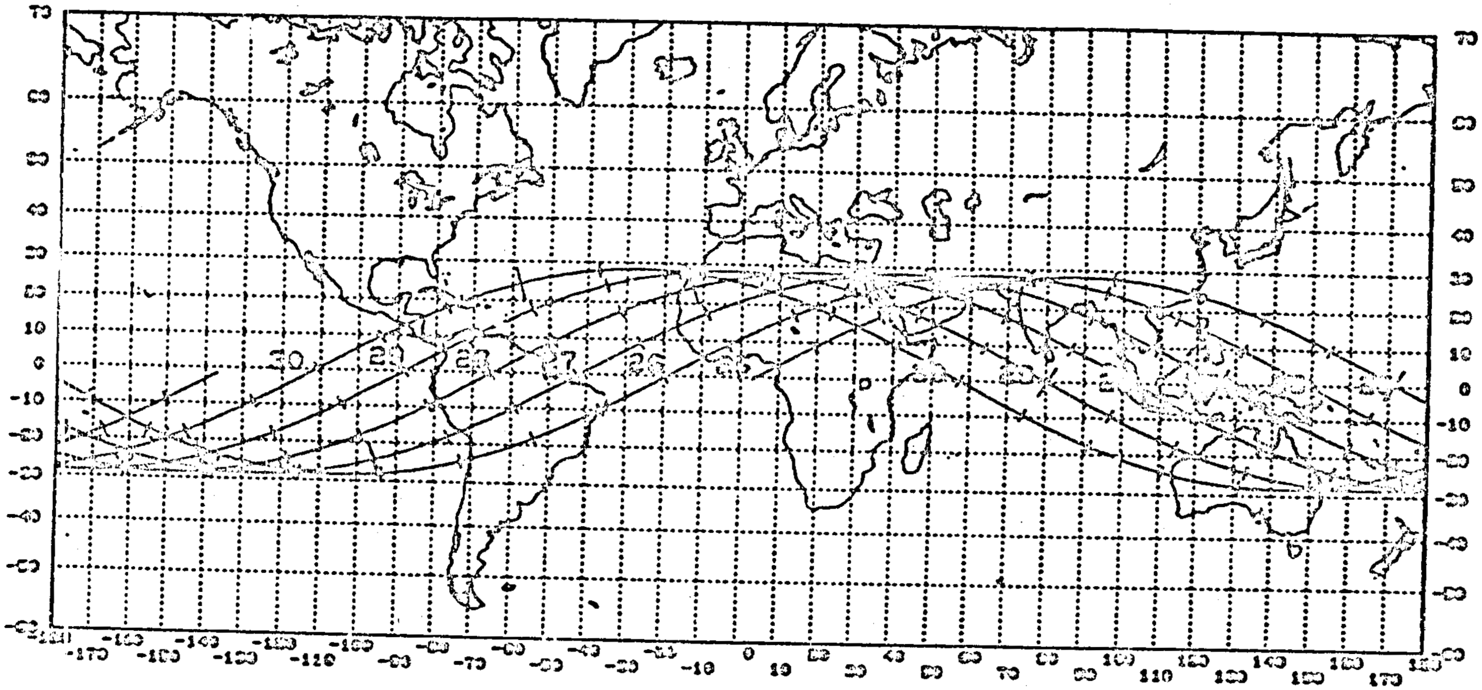
(c) Orbit 12 through orbit 18.

Figure 2.- Continued.



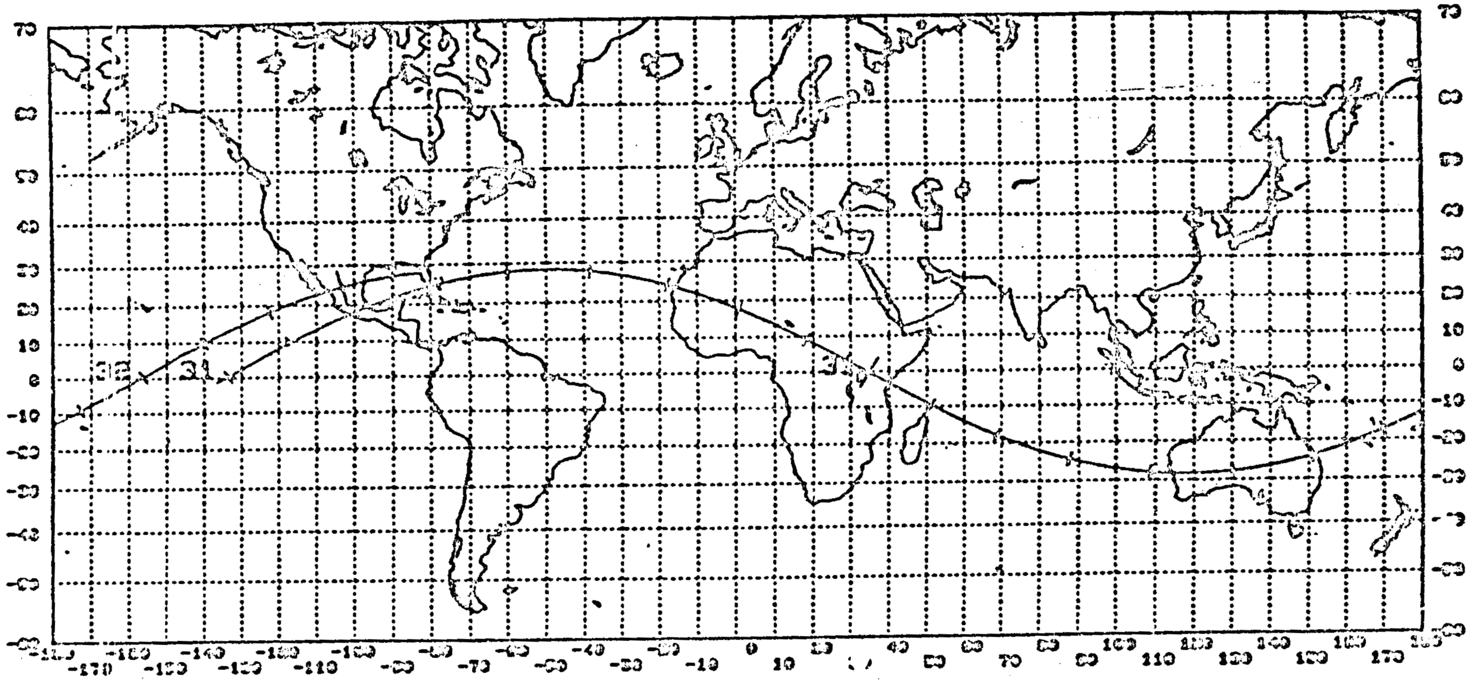
(d) Orbit 13 through orbit 24.

Figure 2.- Continued.



(e) Orbit 24 through orbit 30.

Figure 2.- Continued.



(f) Orbit 30 through landing.

Figure 2.- Continued.

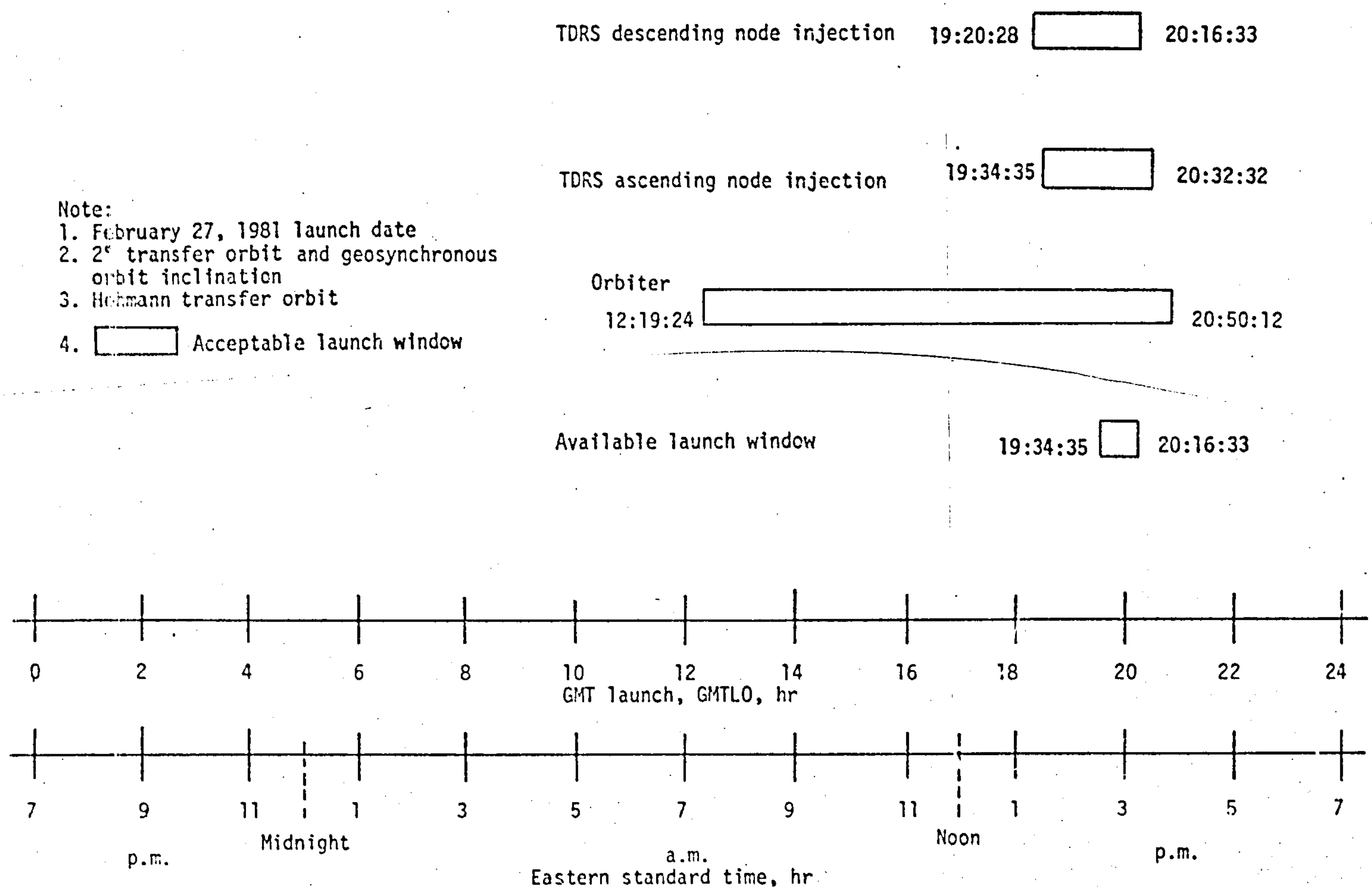


Figure 3.- Flight 7 composite launch window.

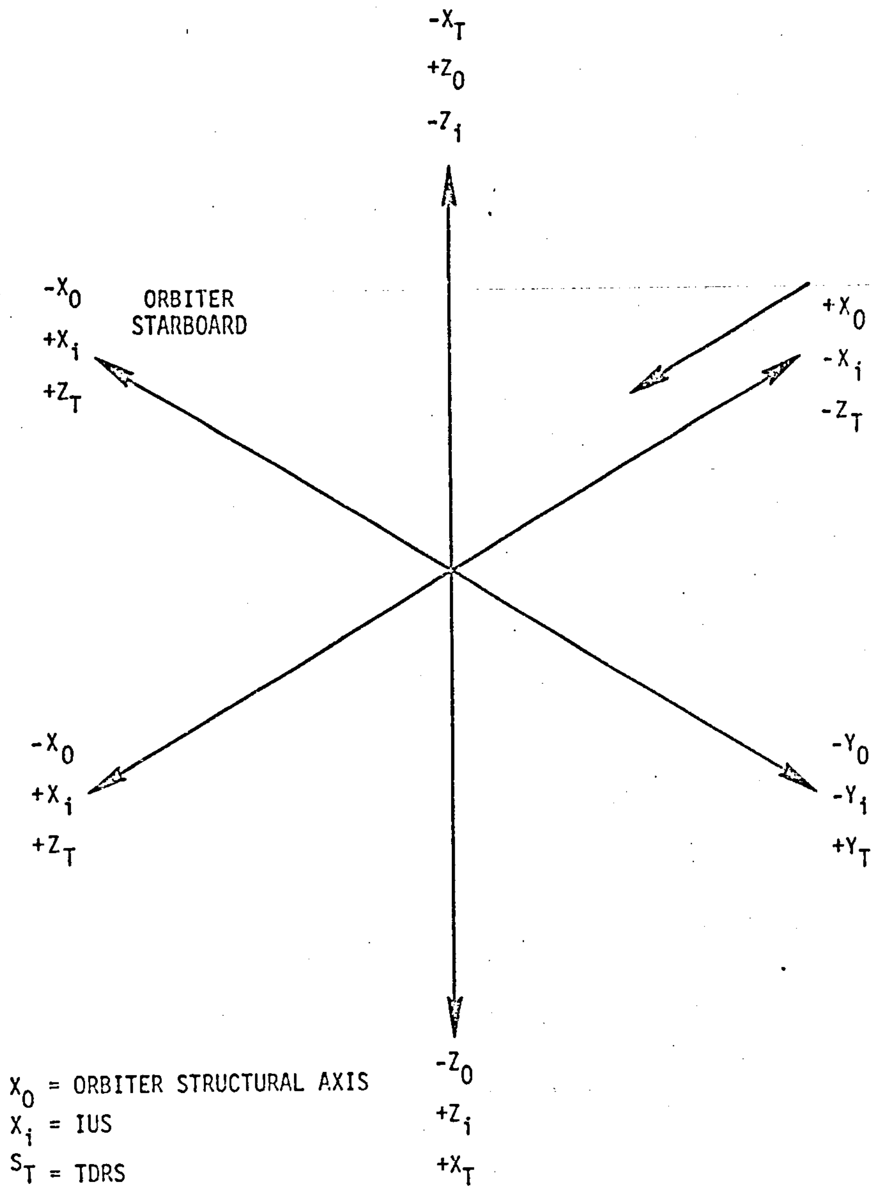
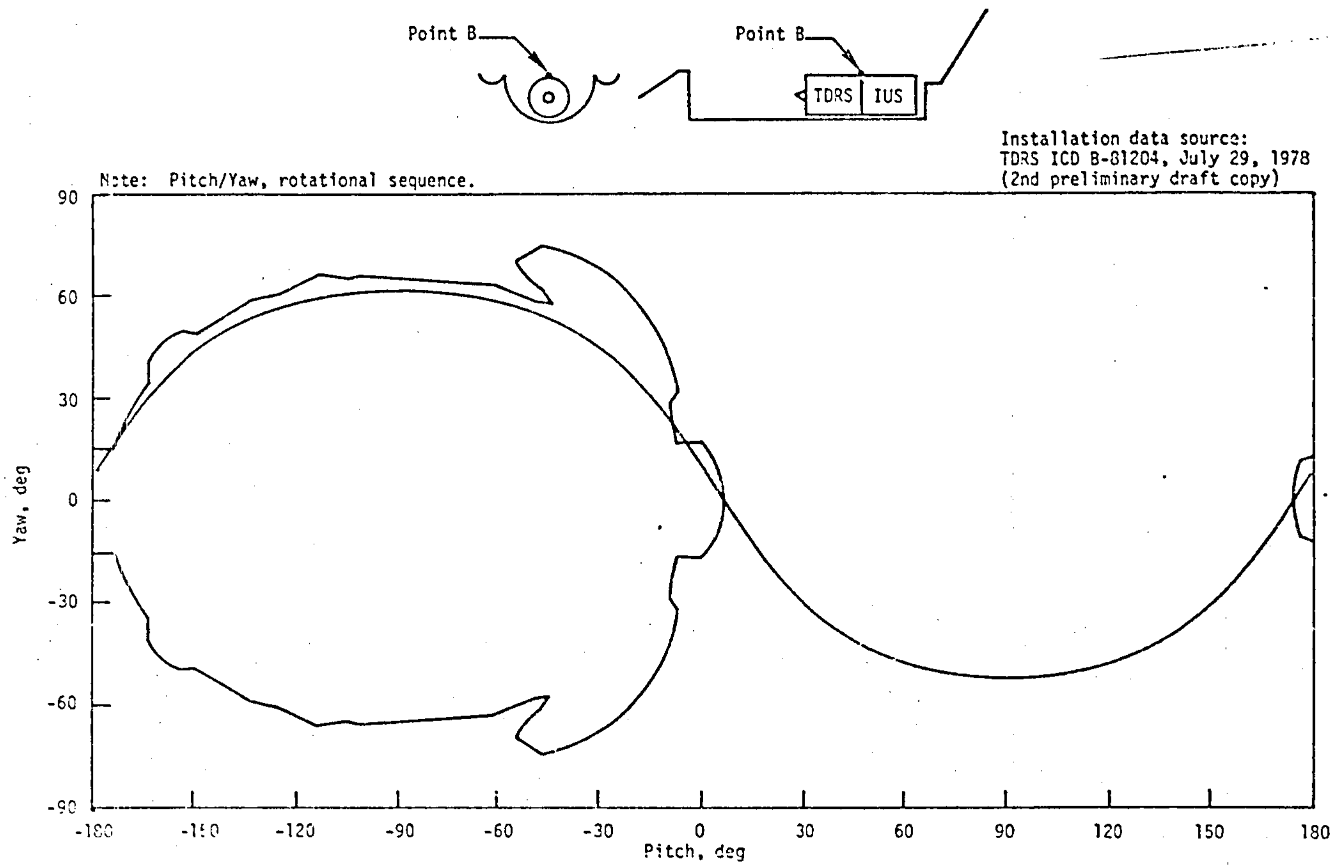
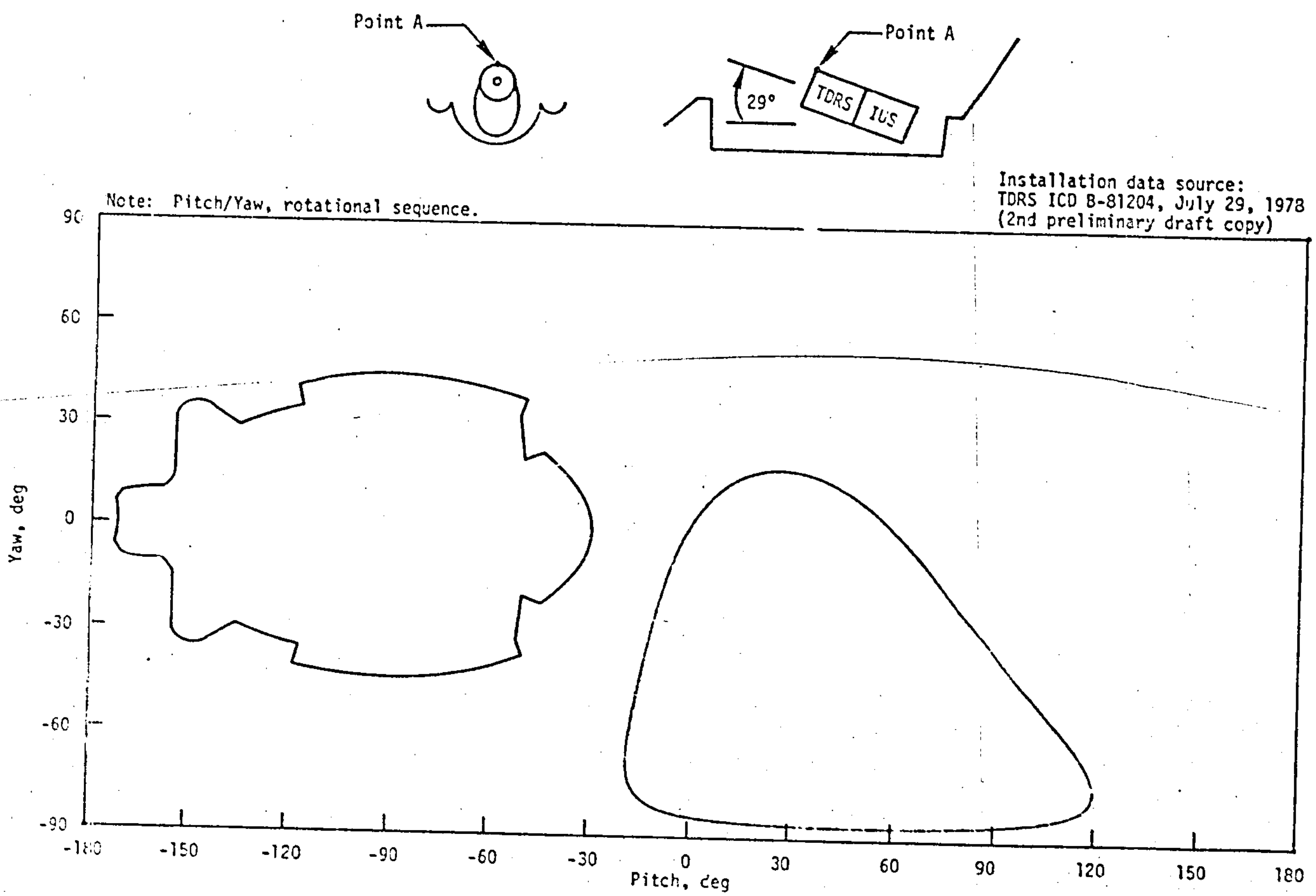


Figure 4.- Definition of orbiter, IUS, and TDRS coordinate systems.



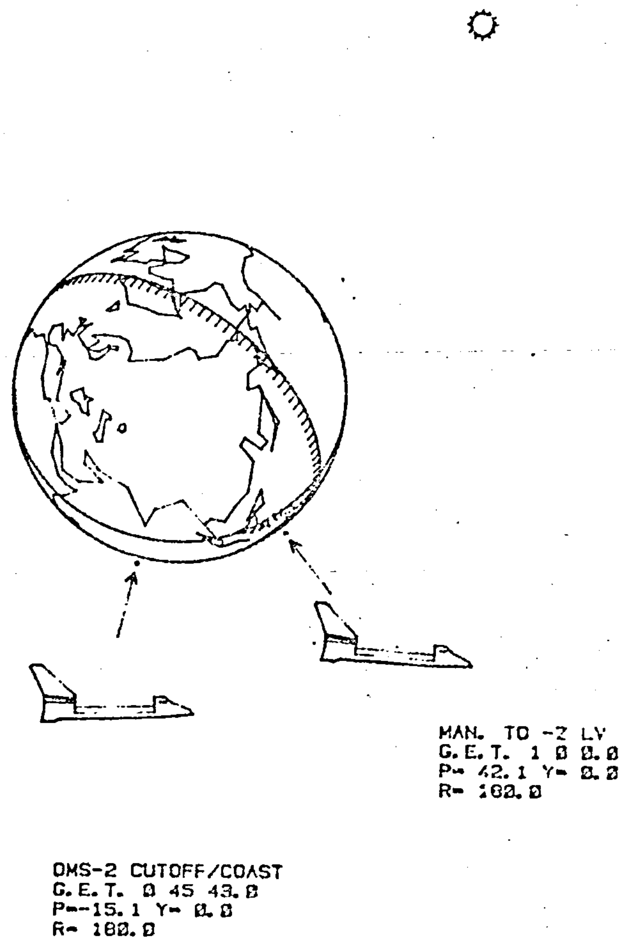
(a) Point B stowed.

Figure 5.- Orbiter blockage map for TDRS/IUS.



(b) Point A elevated.

Figure 5.- Continued.

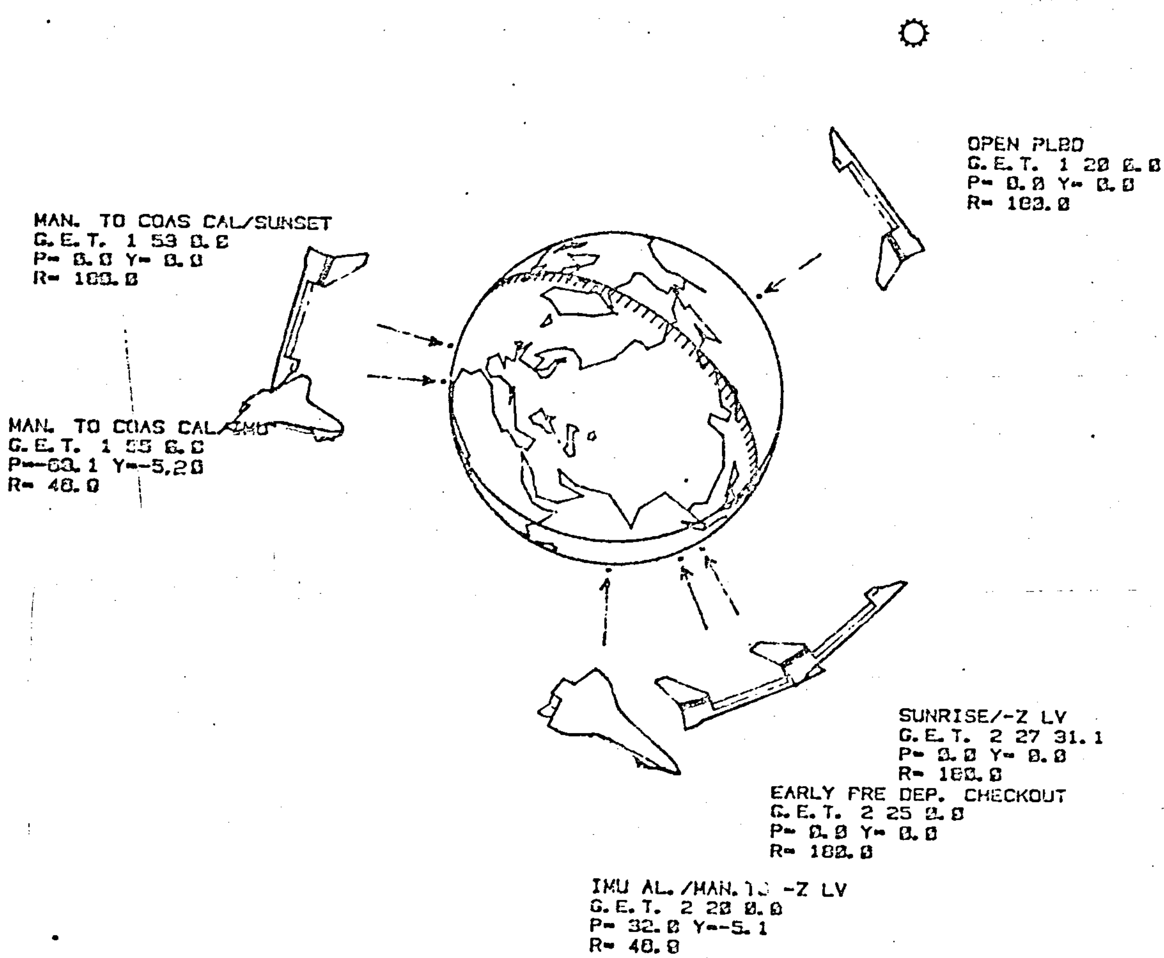


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to
orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Onorbit pictorial summaries.
Orbit No. 1 - (node to node)

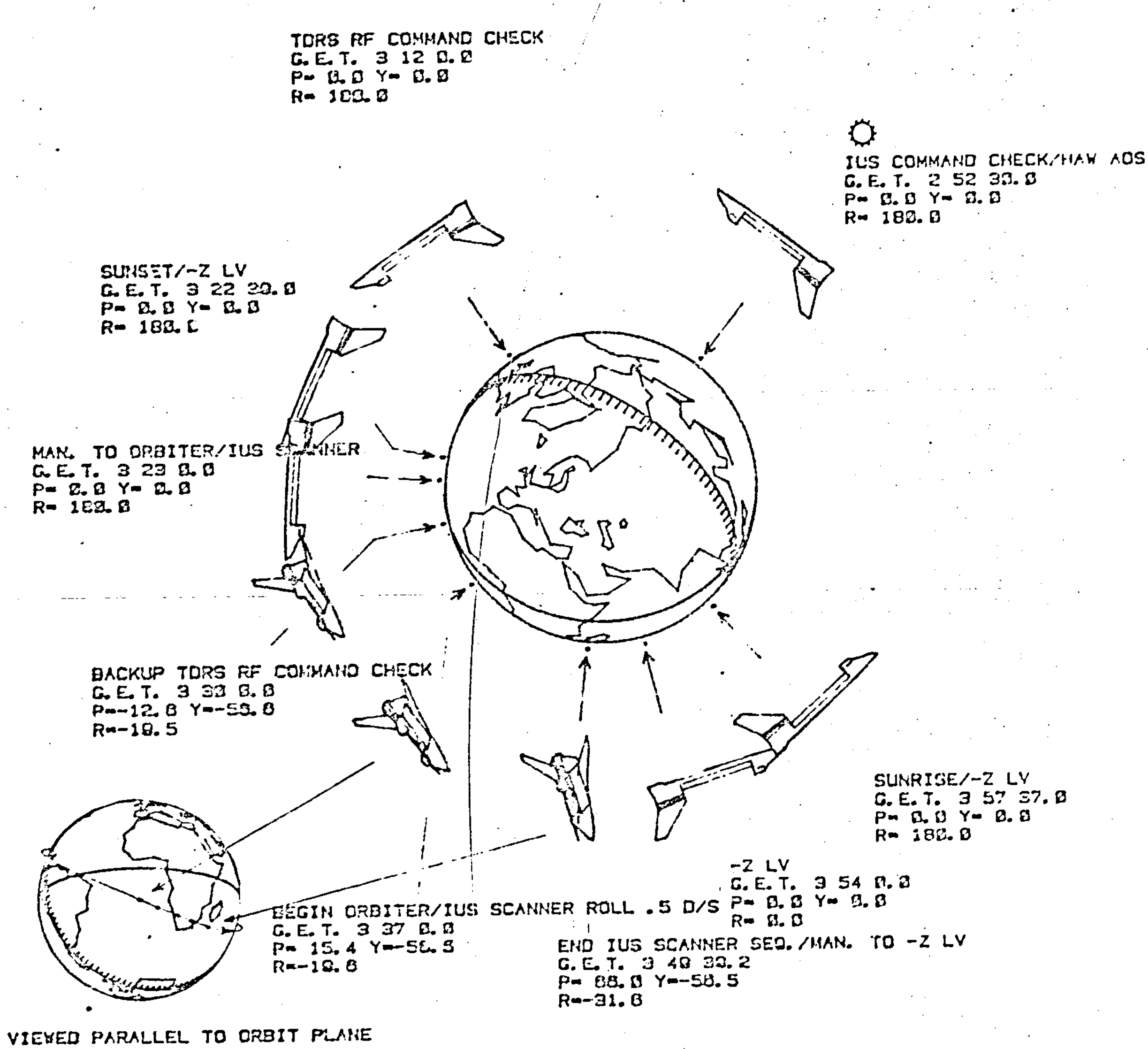


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 2 - (node to node)



LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.

Orbit No. 3 - (node to node)

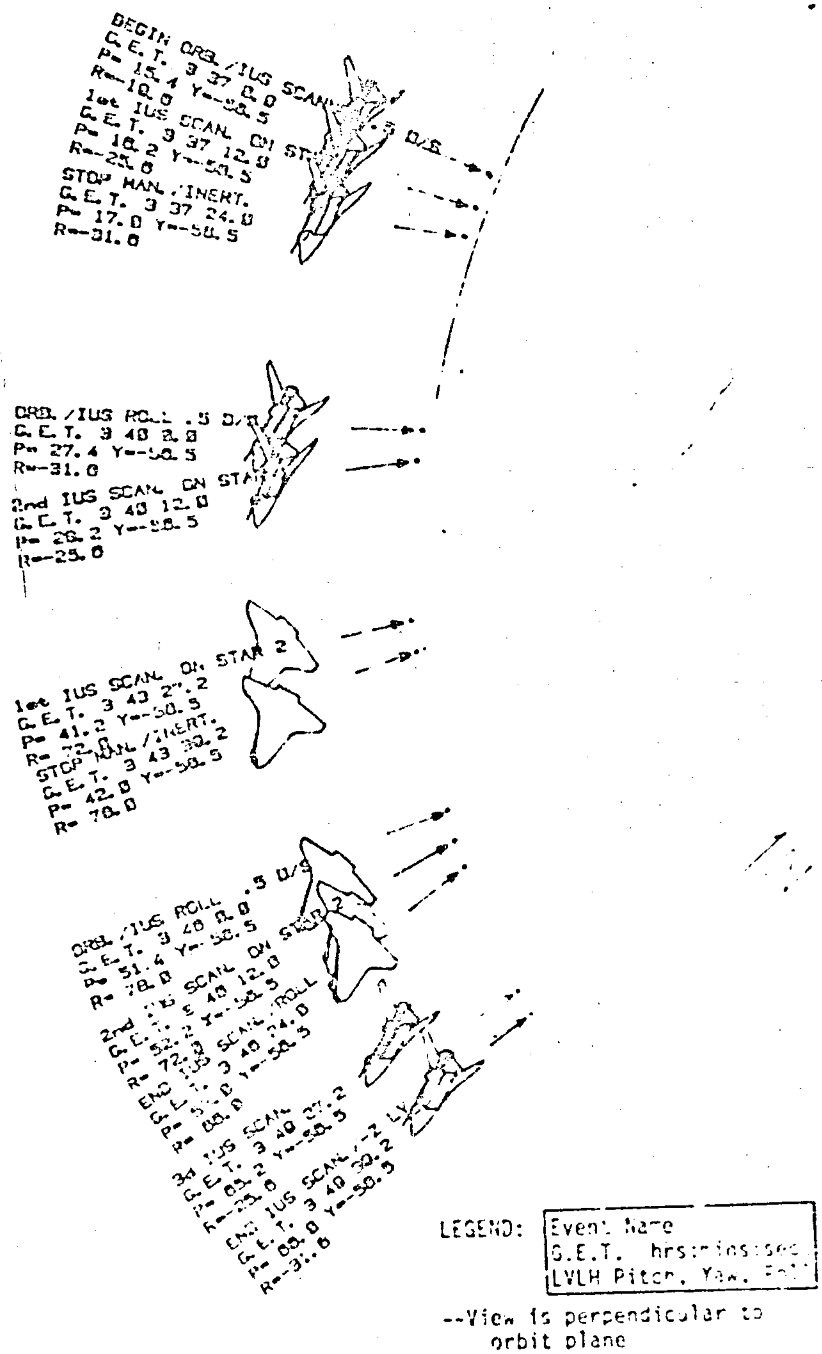
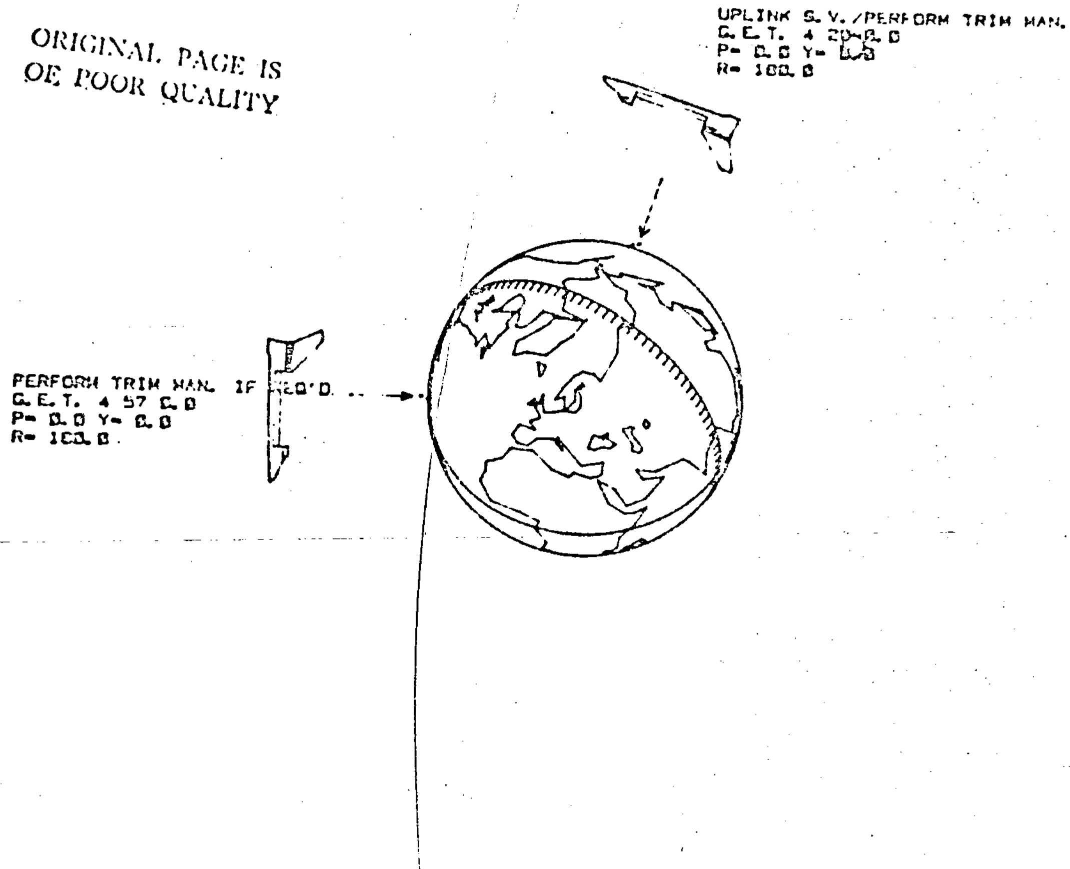


Figure 6.- Continued.
Orbit No. 3 - (node to node)



LEGEND: Event Name
G.E.T. hrs:min:sec
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth shadow
--β≤0° shows sun as ○

Figure 6.- Continued.

Orbit No. 4 - (node to node)

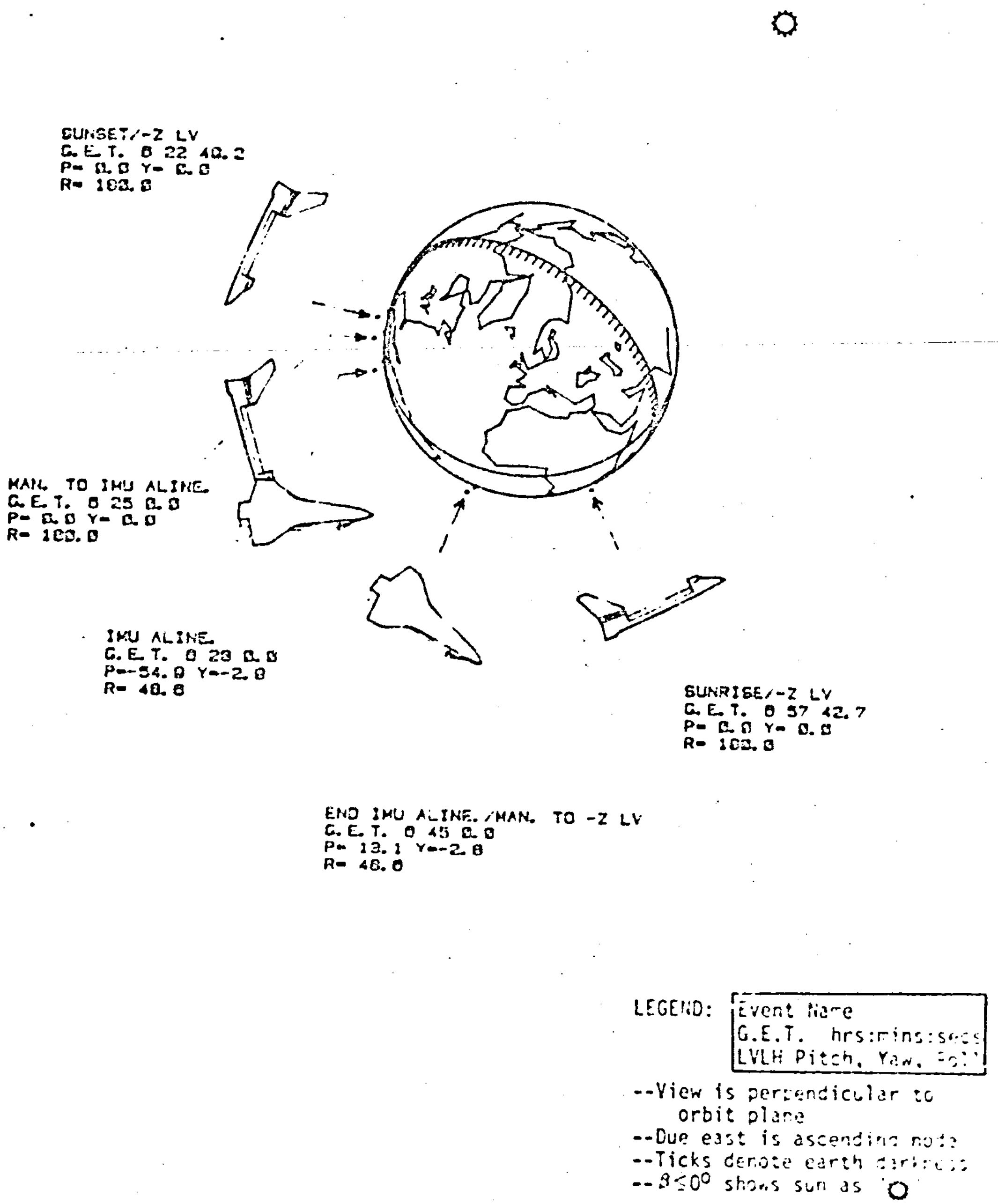


Figure 6.- Continued.

Orbit No. 5 - (node to node)

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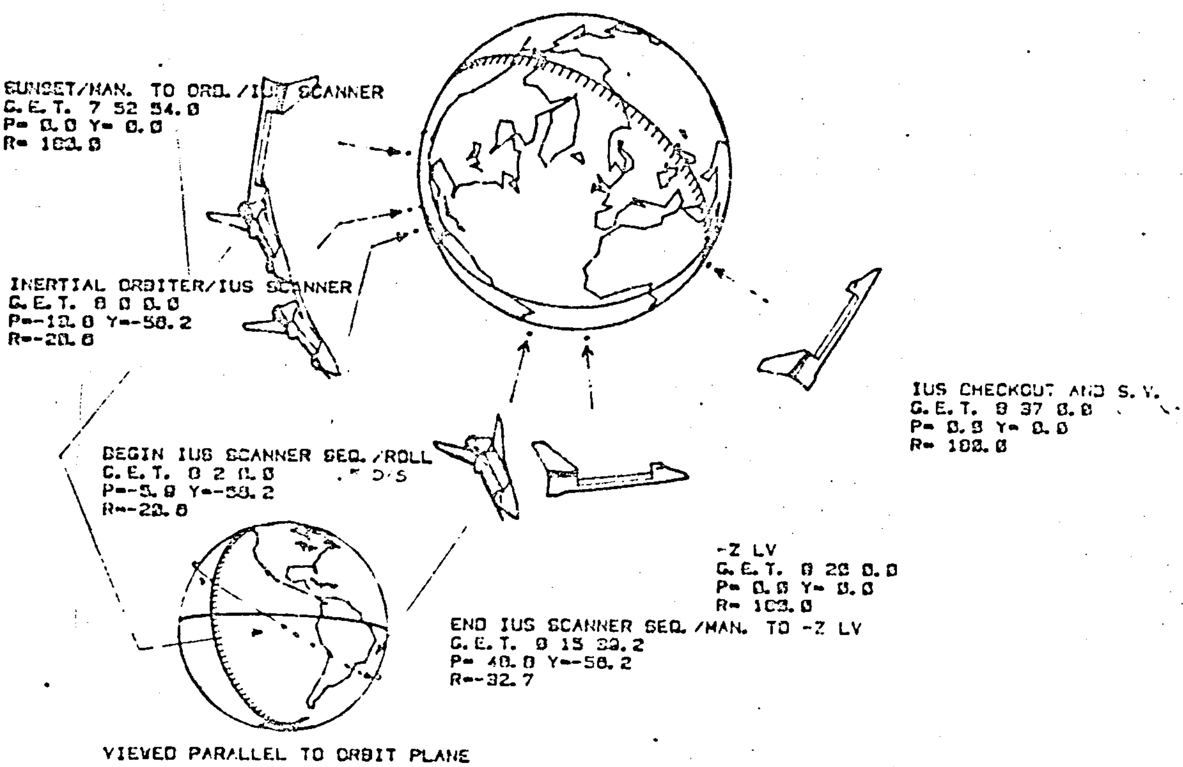
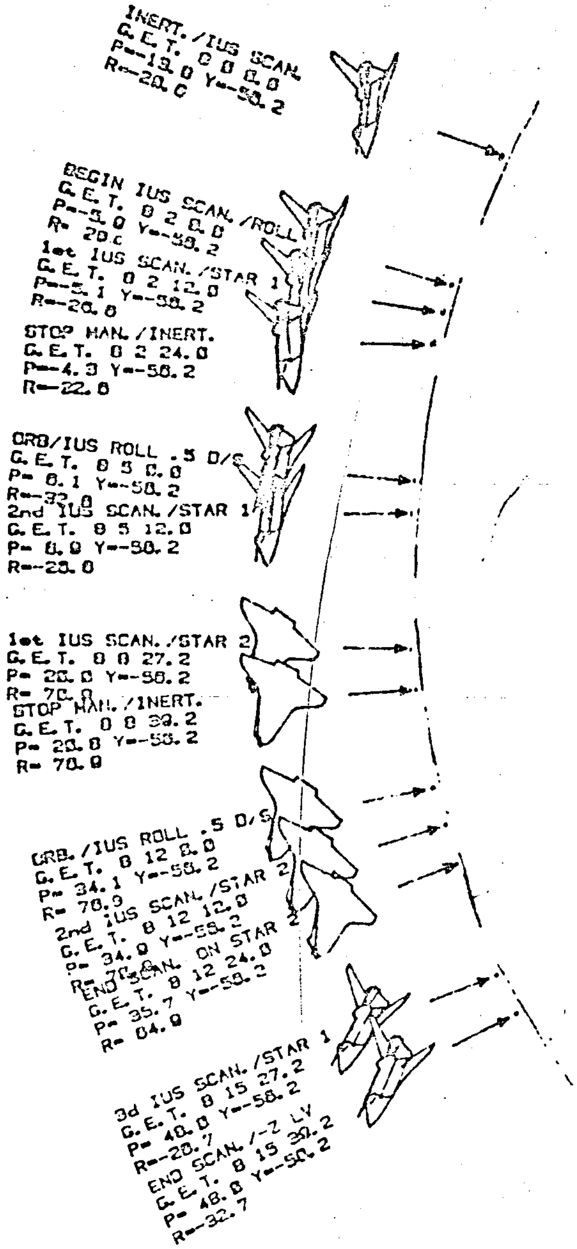


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 6 - (node to node)



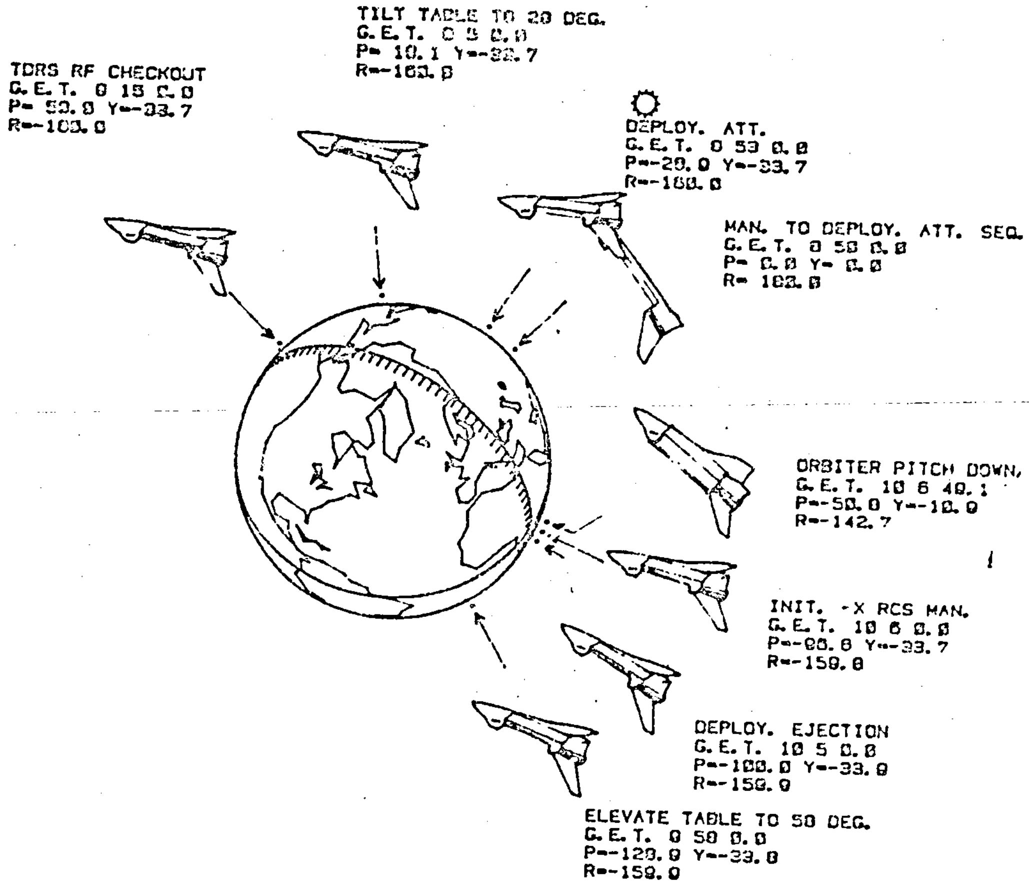
LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane

Figure 6.- Continued.

Orbit No. 6 - (node to node)

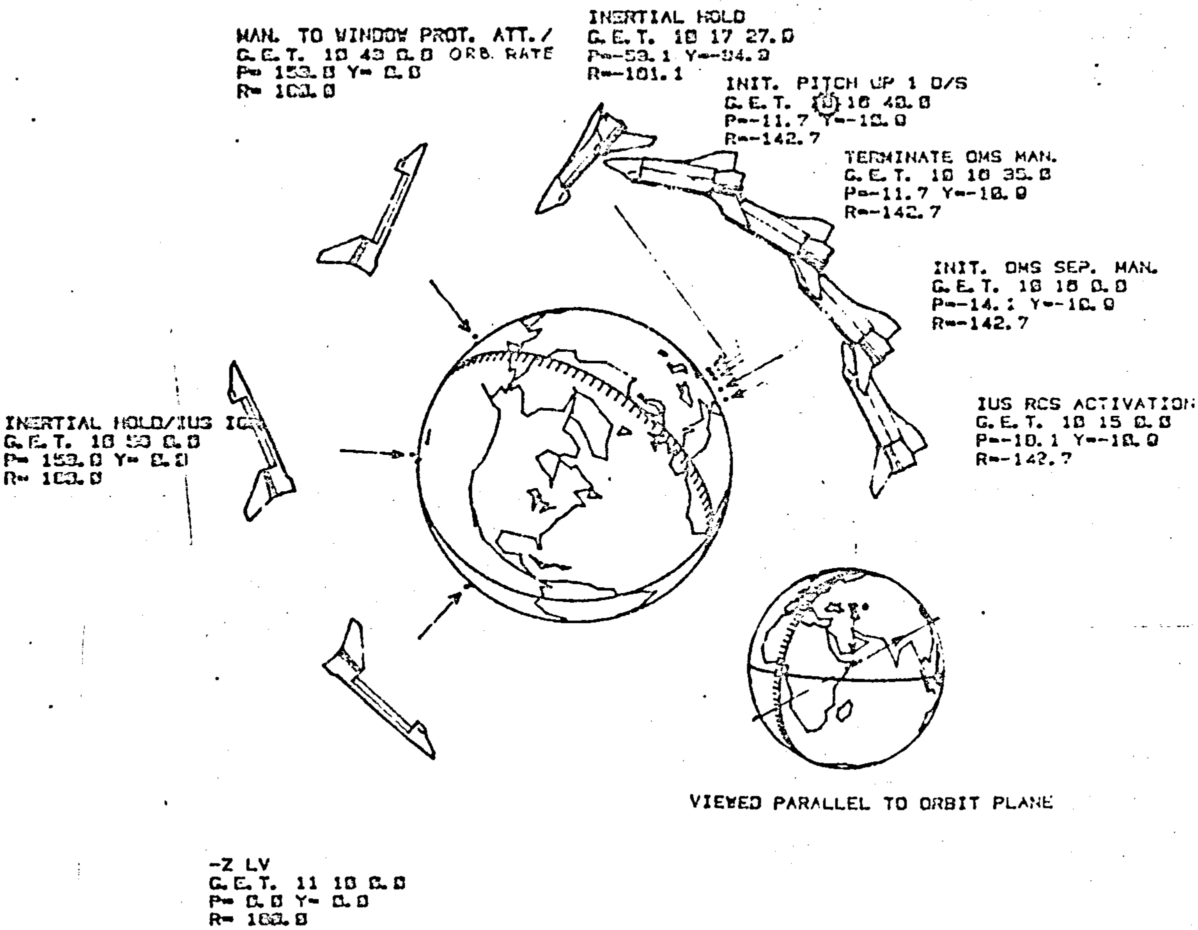


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 7 - (node to node)

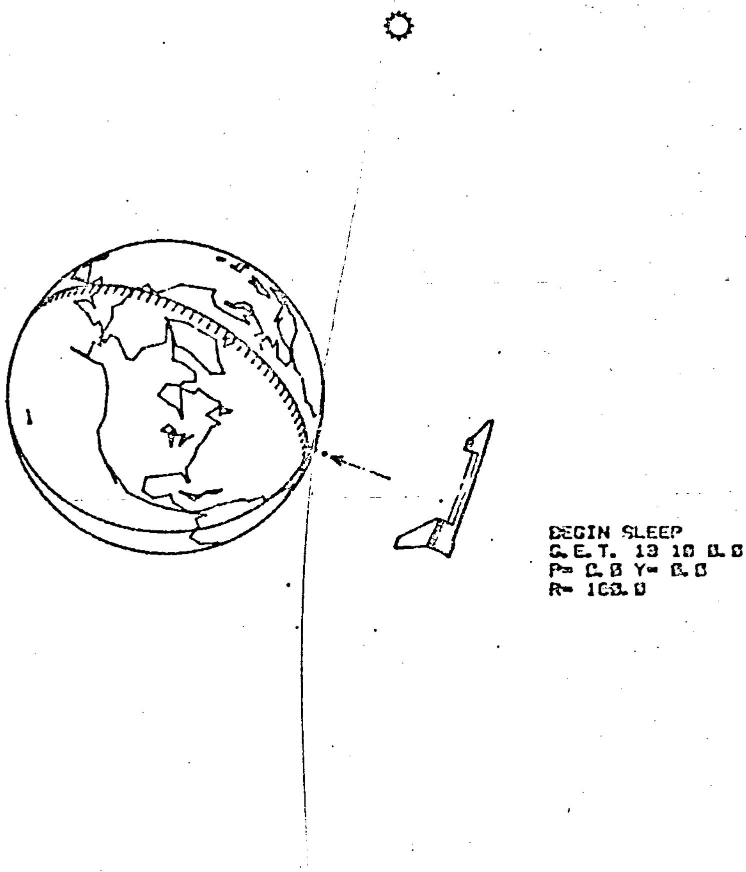


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 8 - (node to node)



LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 9 - (node to node)

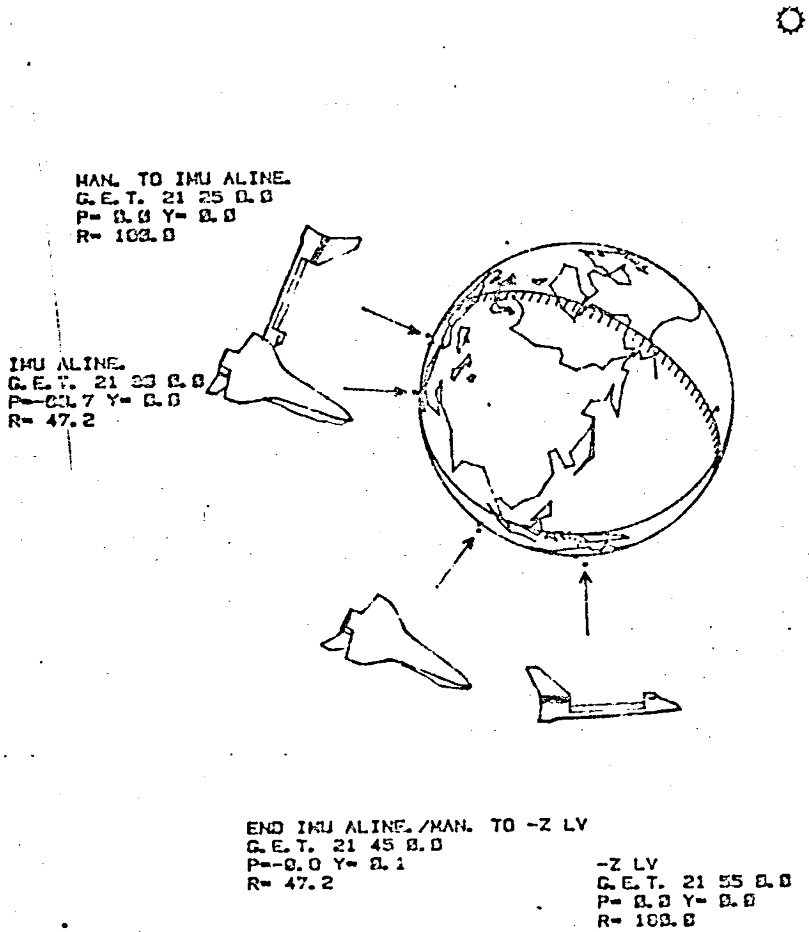
END SLEEP/-Z LV
G.E.T. 20 15 0.0
P= 0.0 Y= 0.0
R= 100.0

LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^{0}$ shows sun as "☼"

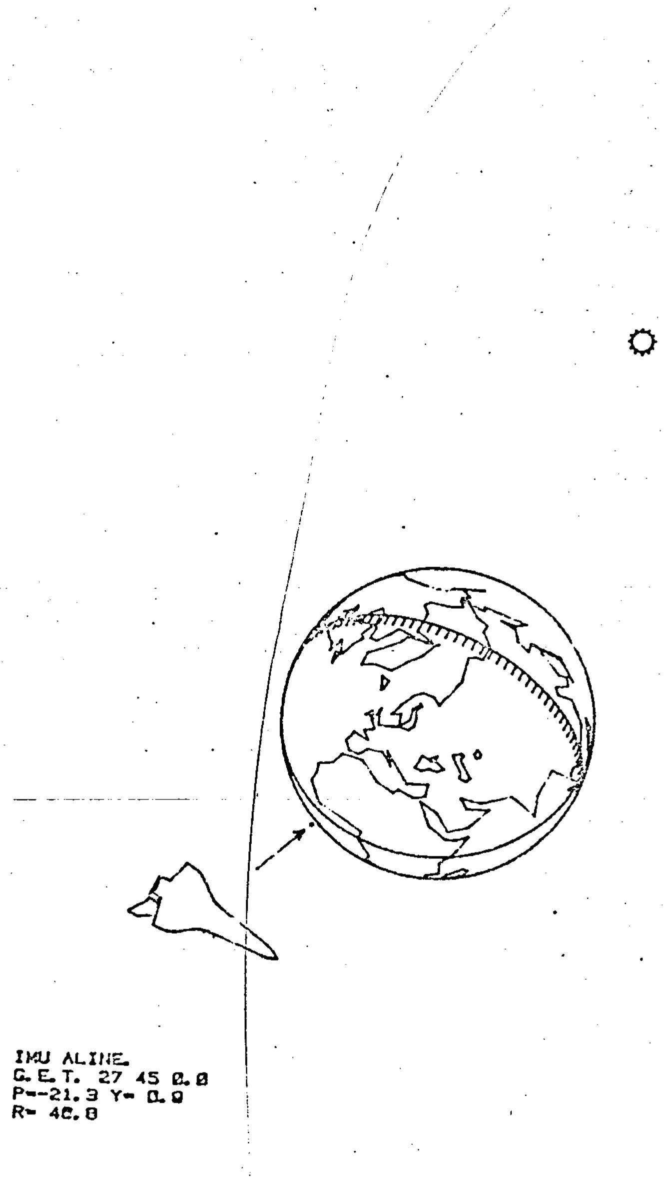
Figure 6.- Continued.
Orbit No. 14 - (node to node)



LEGEND:	Event Name G.E.T. hrs:mins:secs LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^{0}$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 15 - (node to node)

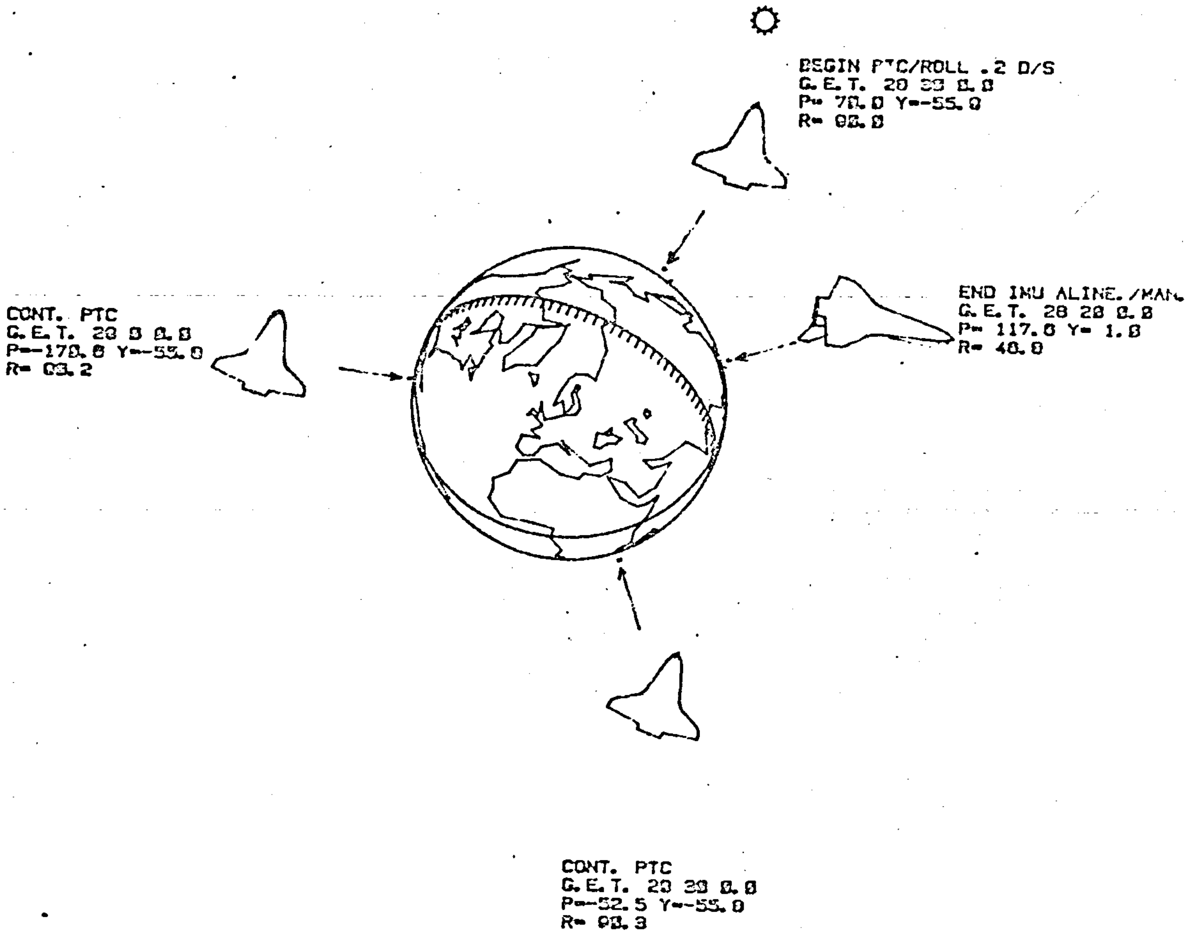


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^{0}$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 19 - (node to node)

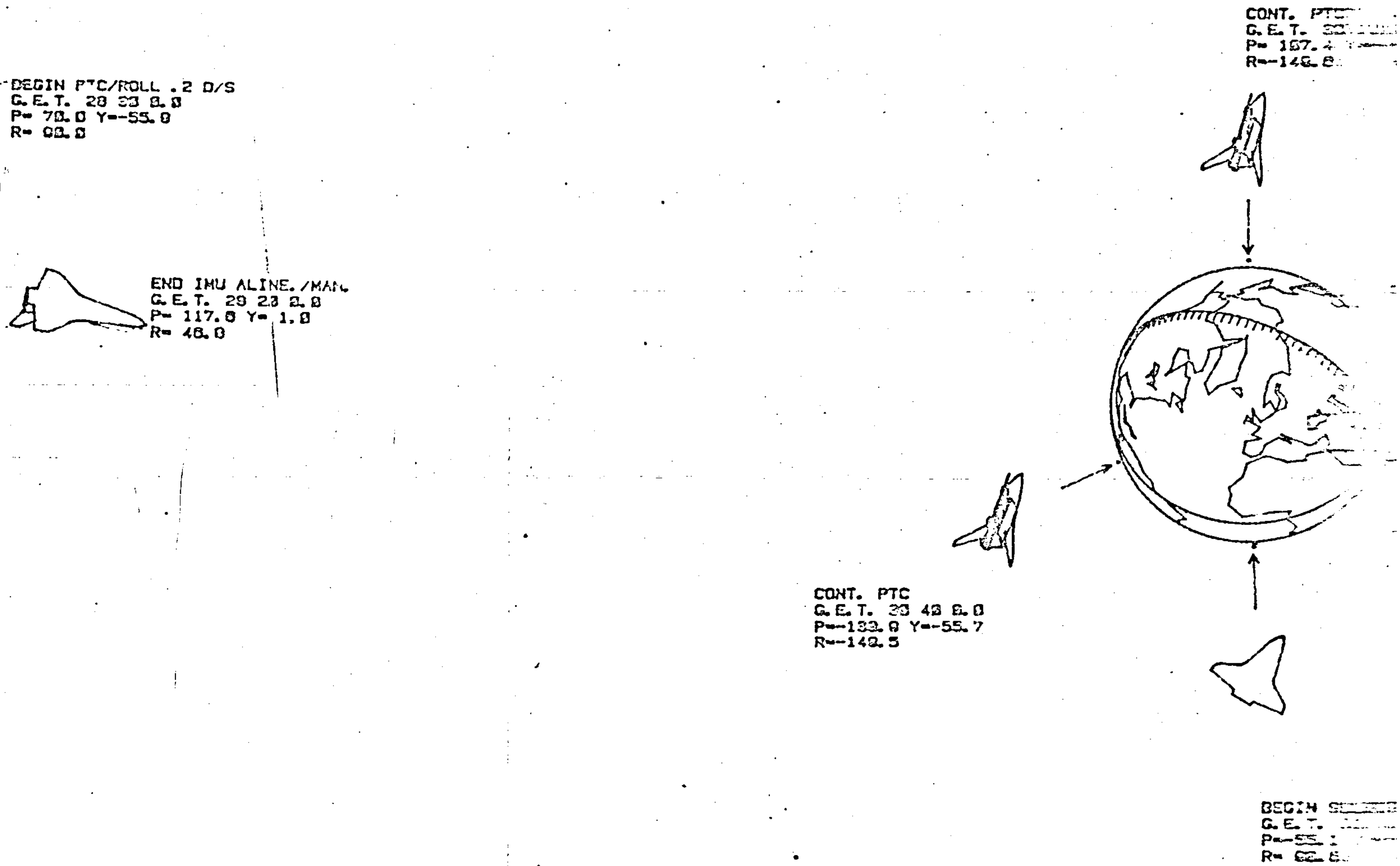


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^{0}$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 20 - (node to node)

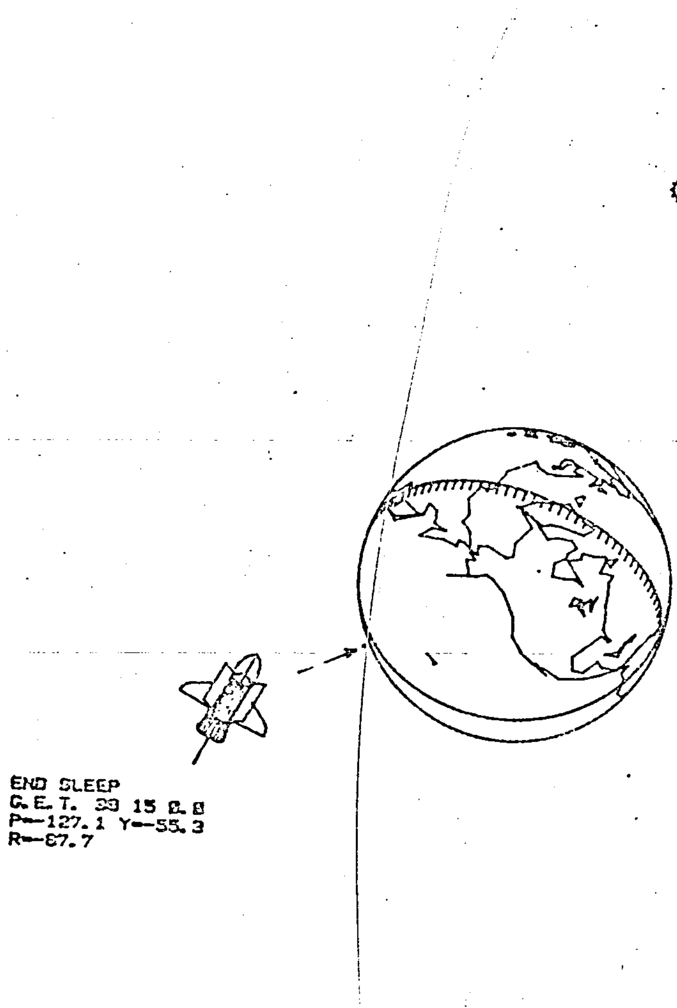


Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

is perpendicular to
it plane
ast is ascending node
denote earth darkness
shows sun as "☼"

Figure 6.- Cont

Orbit No. 21 - (no



LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.

Orbit No. 25 - (node to node)

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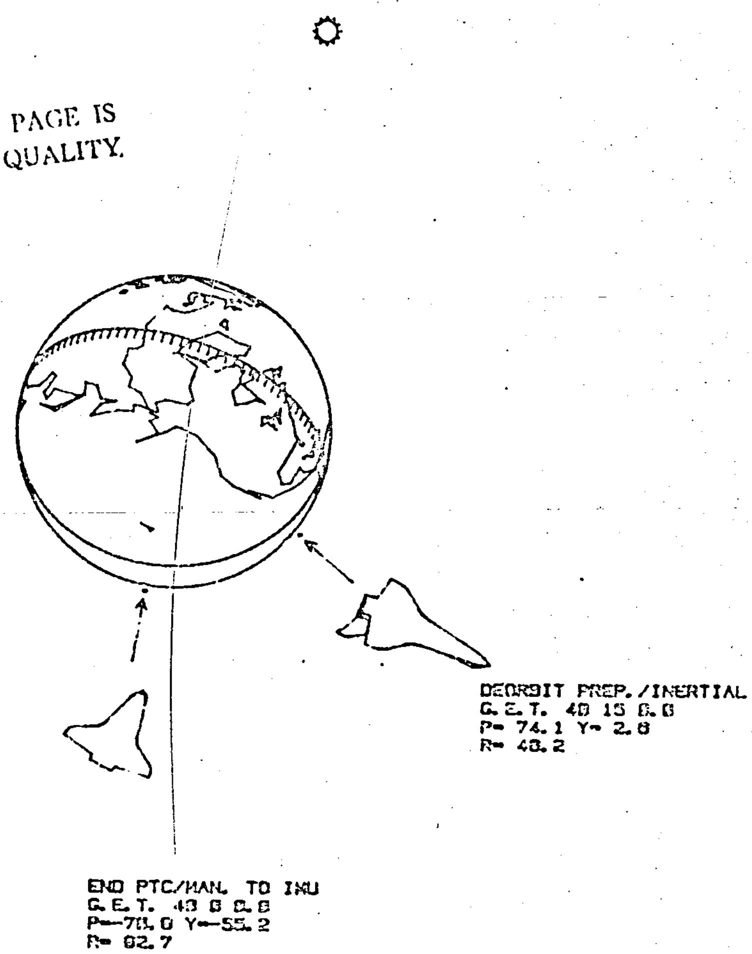


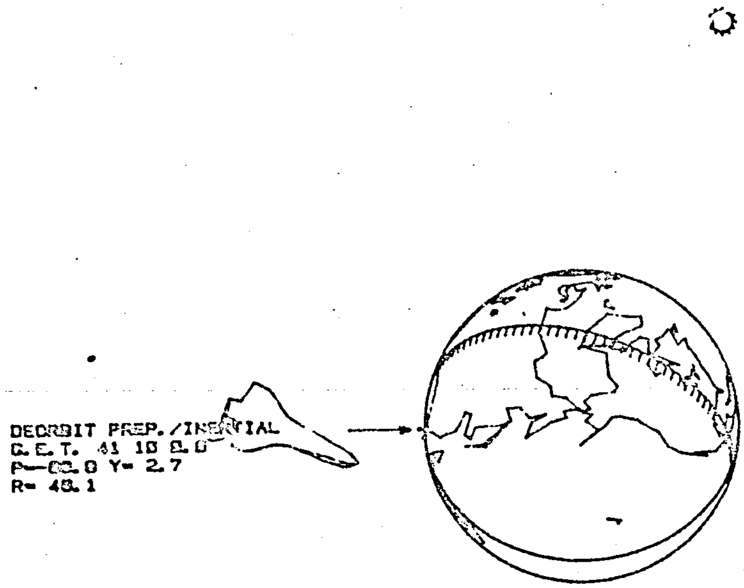
LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

Figure 6.- Continued.

Orbit No. 26 - (node to node)

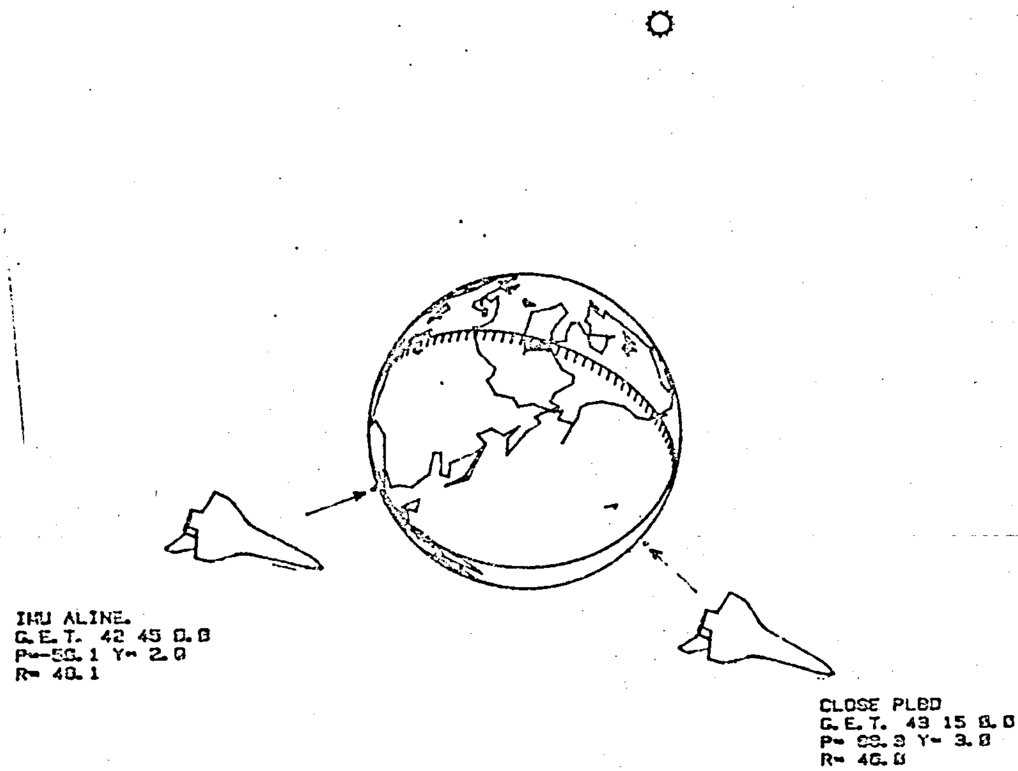


LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^{0}$ shows sun as "☼"

Figure 6.- Continued.
Orbit No. 27 - (node to node)



LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^0$ shows sun as "☼"

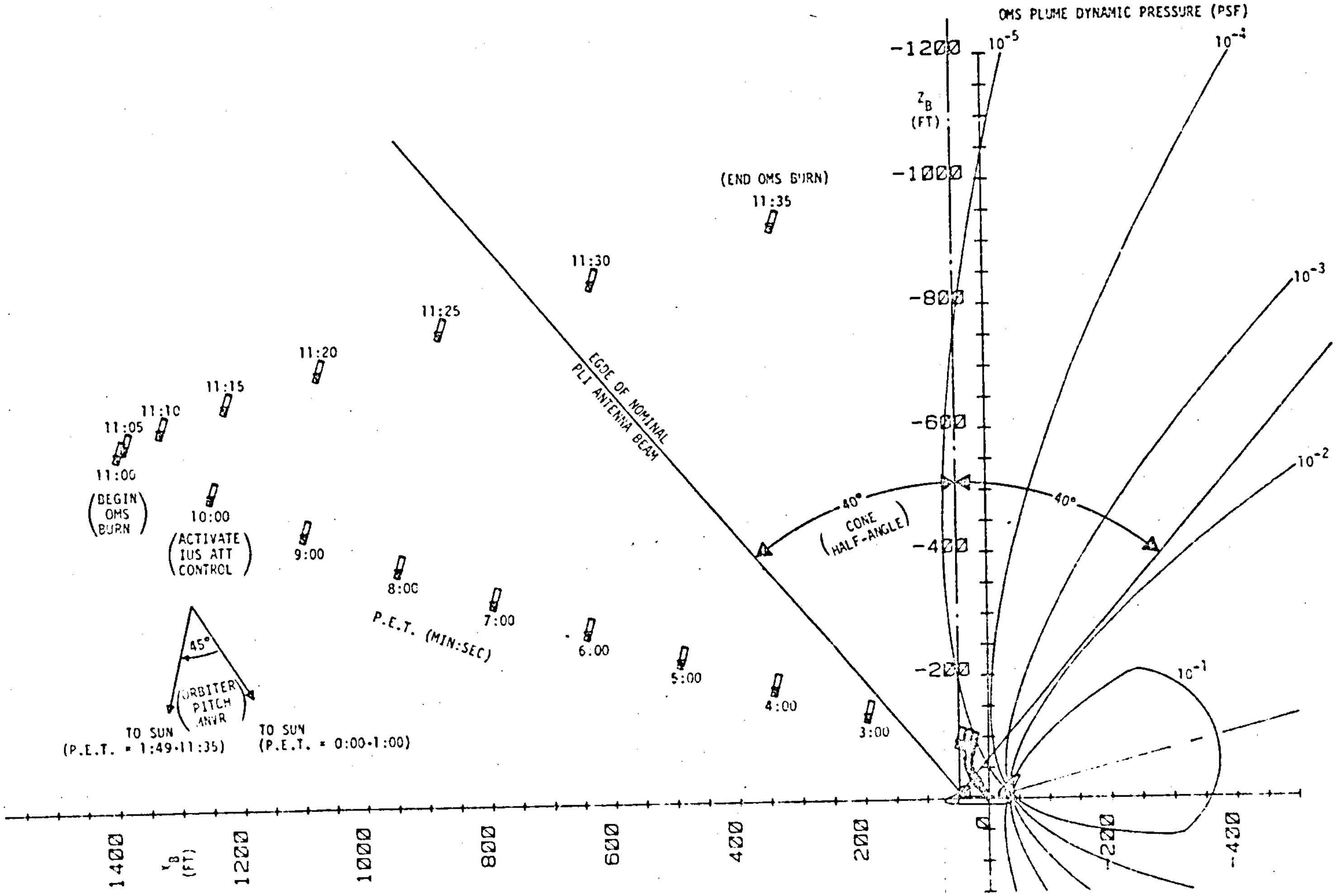
Figure 6.- Continued.
Orbit No. 28 - (node to node)

LEGEND:

Event Name
G.E.T. hrs:mins:secs
LVLH Pitch, Yaw, Roll

--View is perpendicular to orbit plane
--Due east is ascending node
--Ticks denote earth darkness
--$\beta \leq 0^{\circ}$ shows sun as "☼"

Figure 6.- Concluded.
Orbit No. 29 - (node to node)



(a) Sideview of payload motion relative to orbiter (0:00 to 11:35 PET)

Figure 7.- Postseparation relative motion between orbiter and IUS (TDRS-A).

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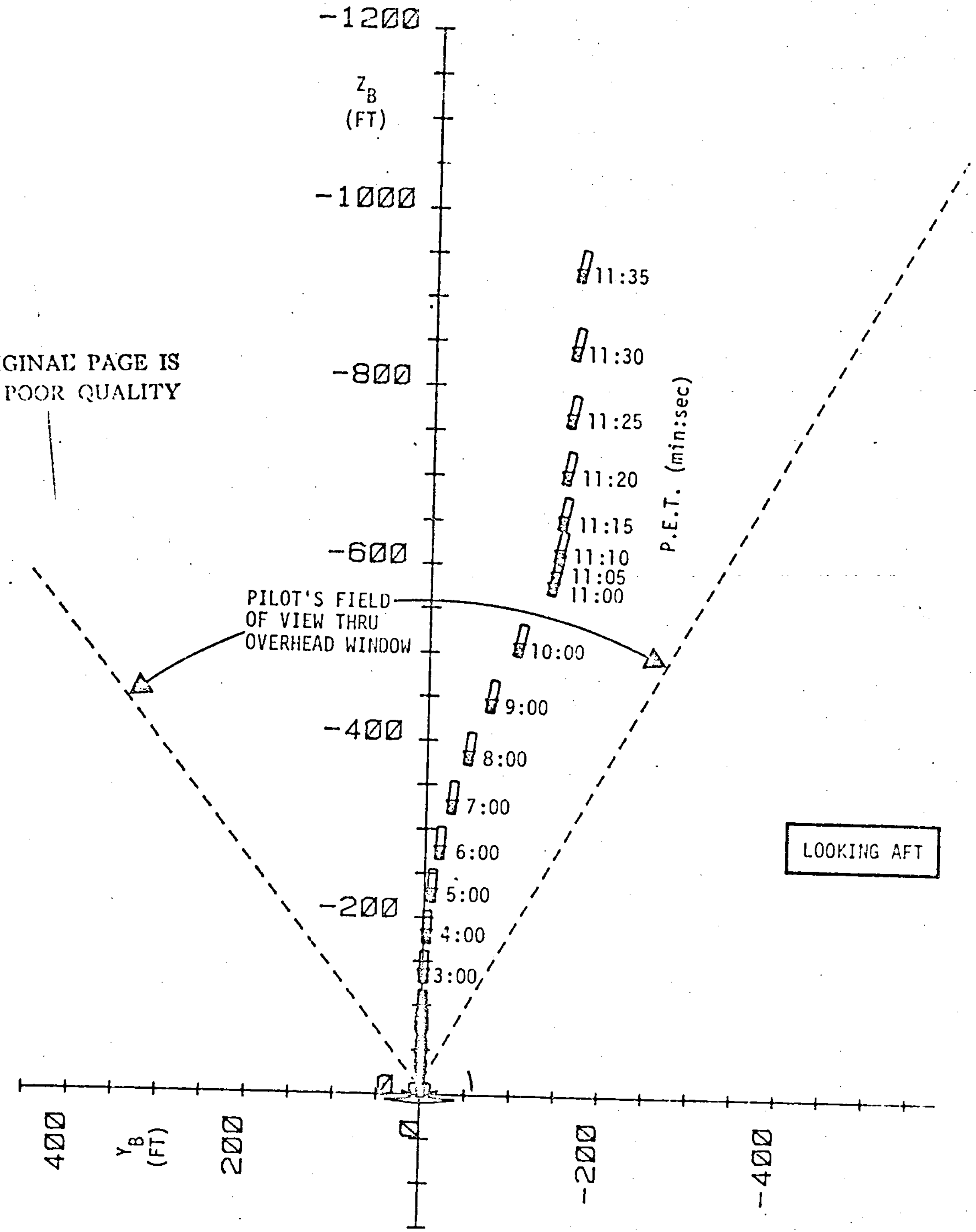
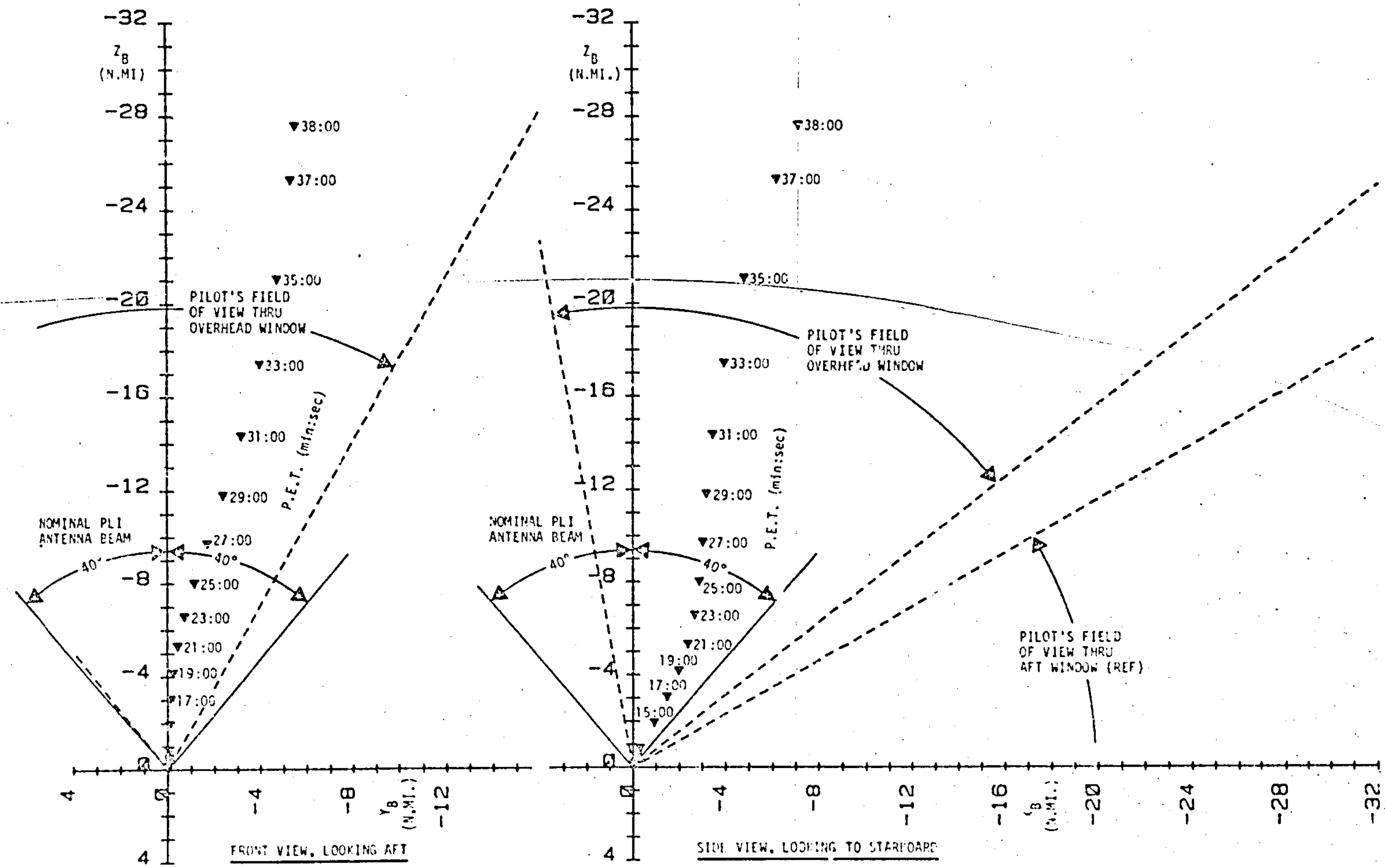


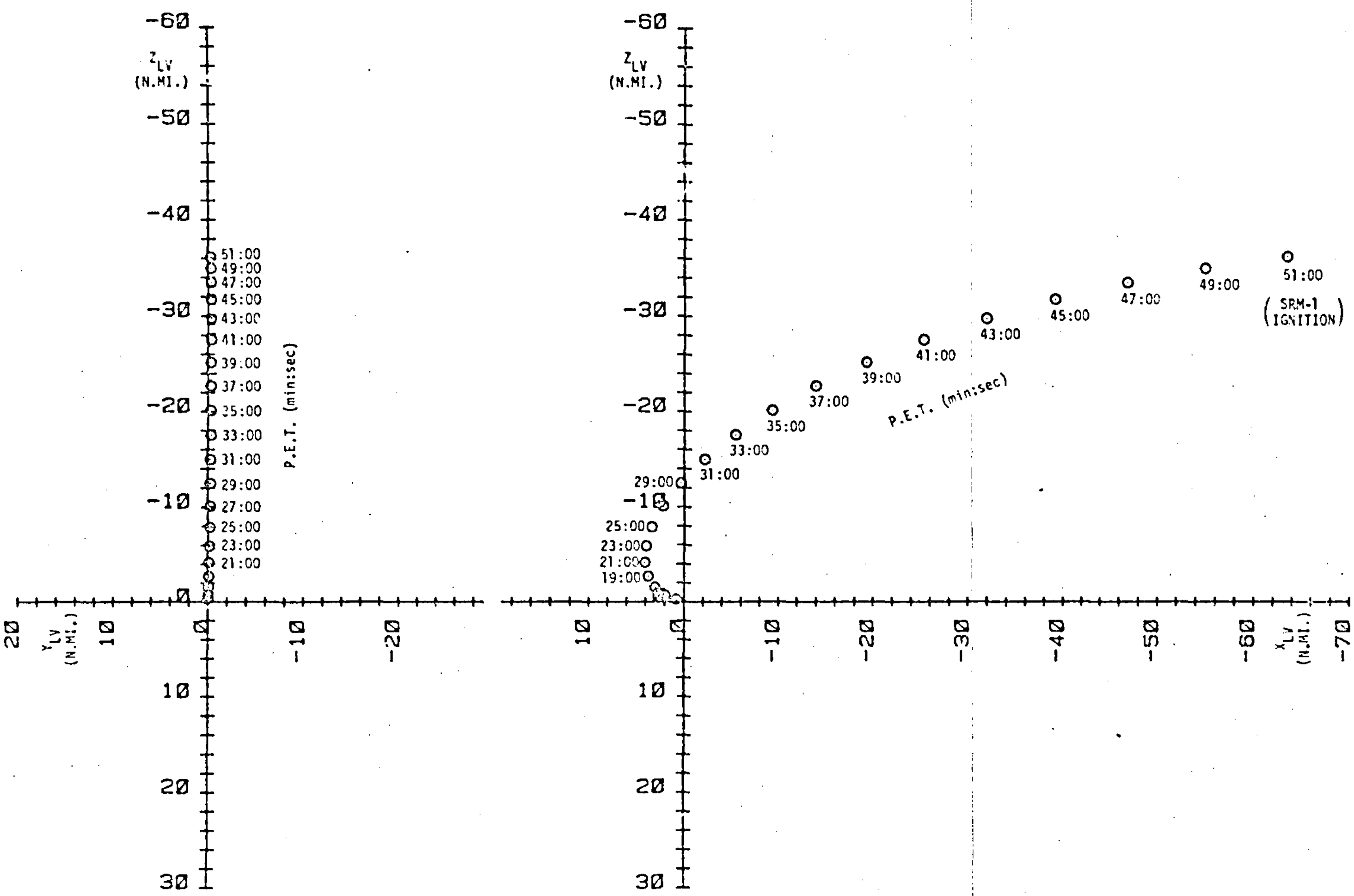
(b) Front view of payload motion relative to orbiter (11:40 to 38:00 PET)

Figure 7.- Continued.



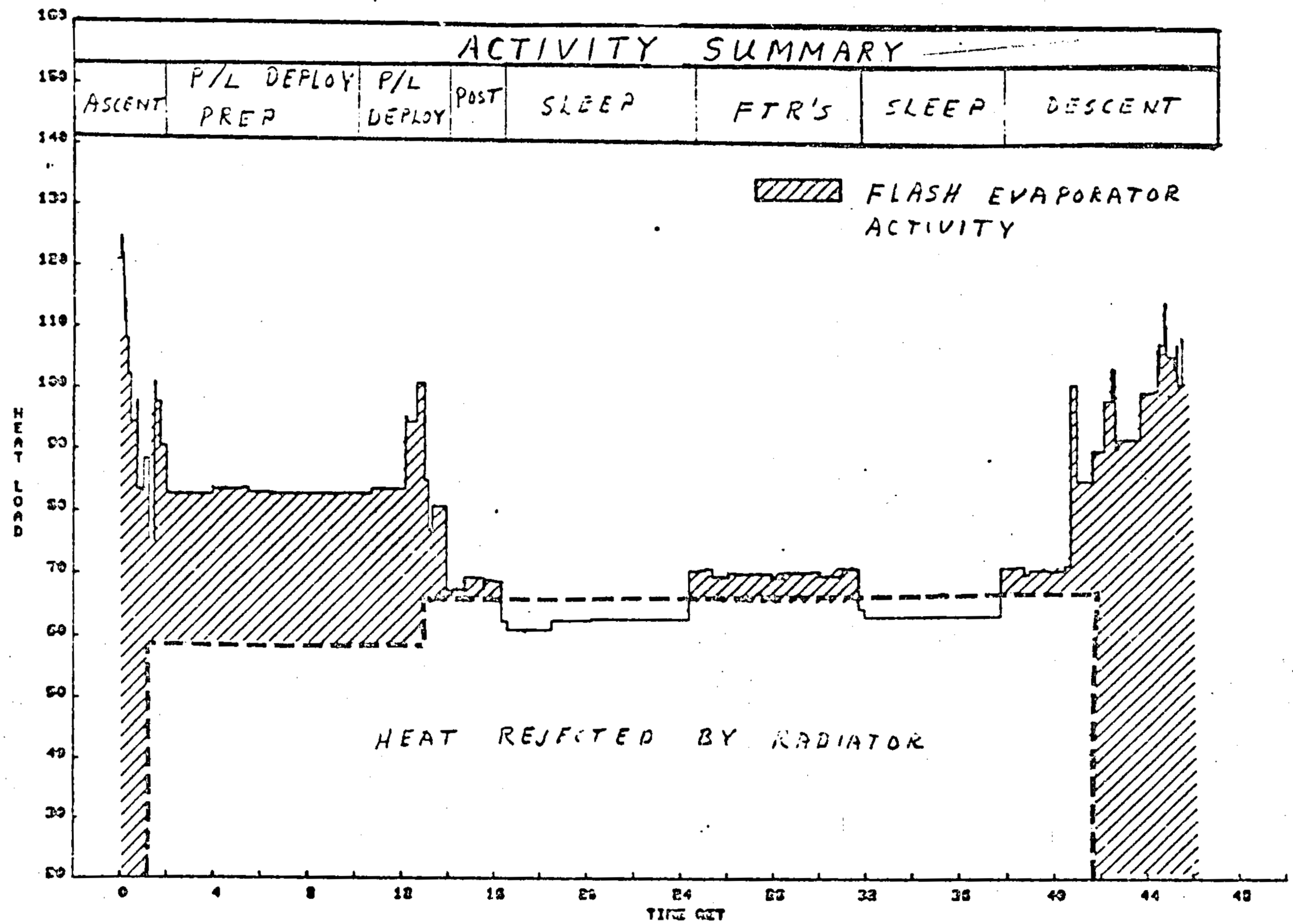
(c) Payload motion relative to orbiter body axes (11:40 to [illegible] PET)

Figure 7.- Continued.



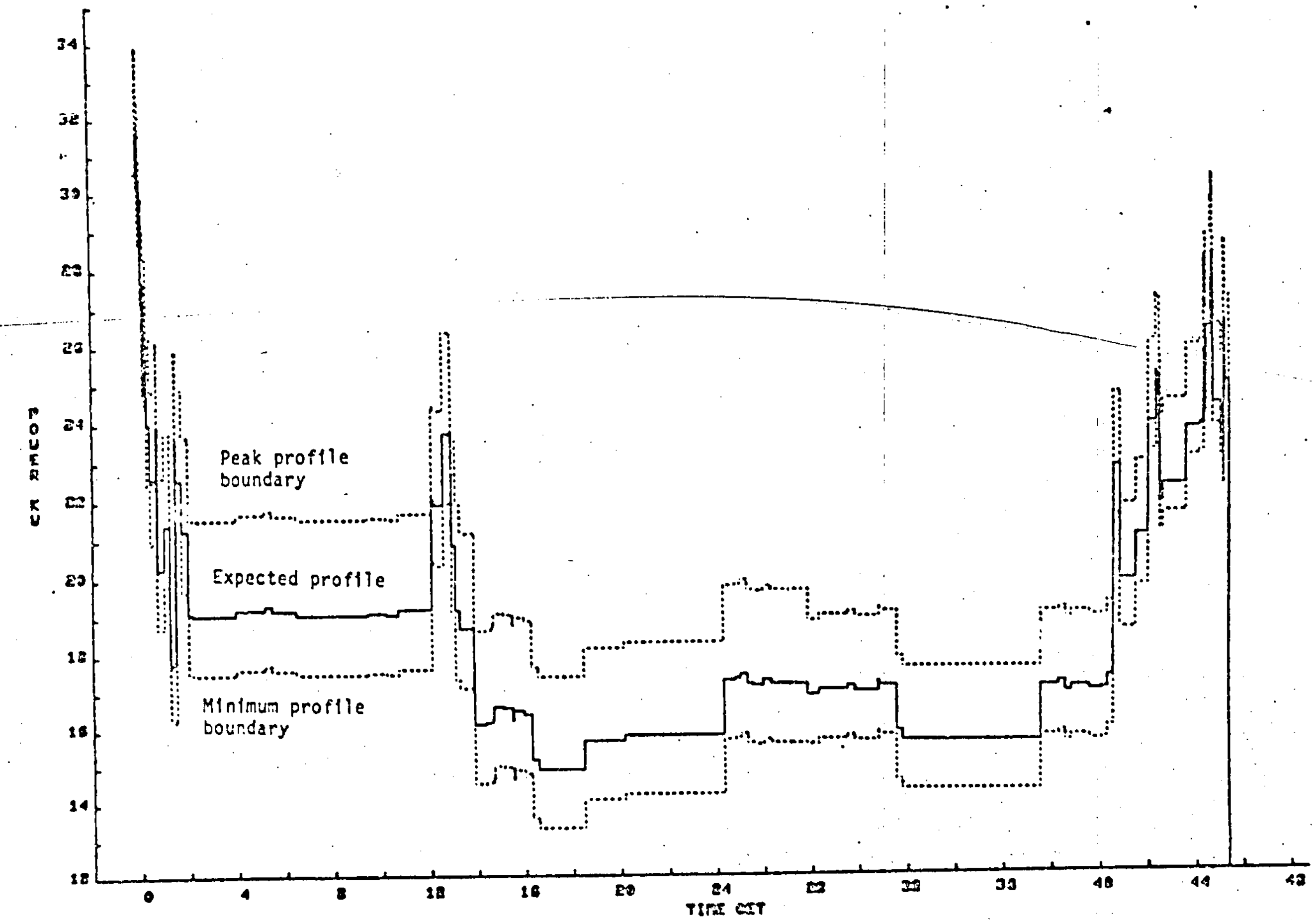
(d) Orbiter LVLH trajectory relative to payload (13:00 to 51:00 PET)

Figure 7.- Concluded.



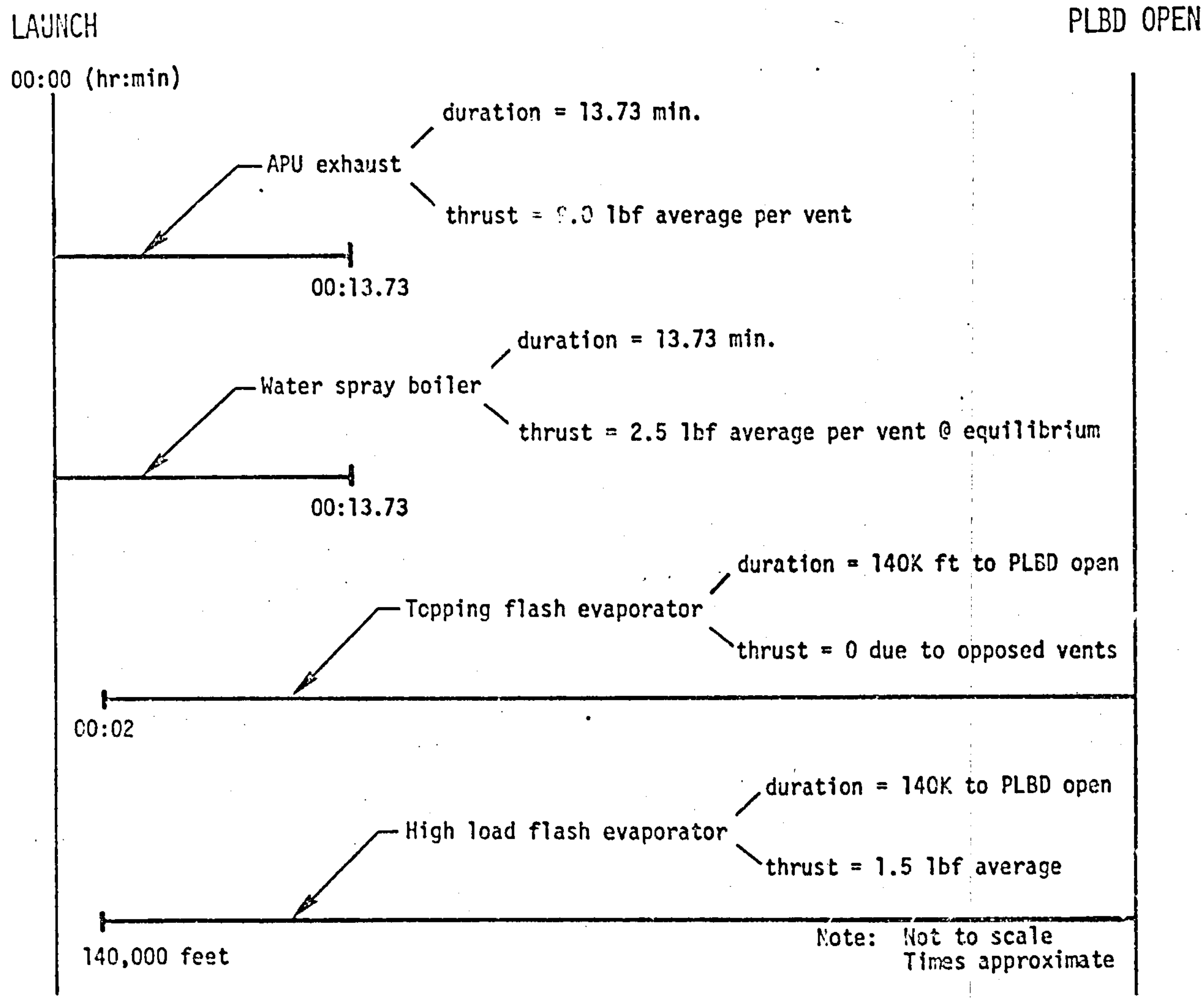
(a) Flight 7 active thermal control system thermal profile.

Figure 8.- Flight 7 nonpropulsive consumables.



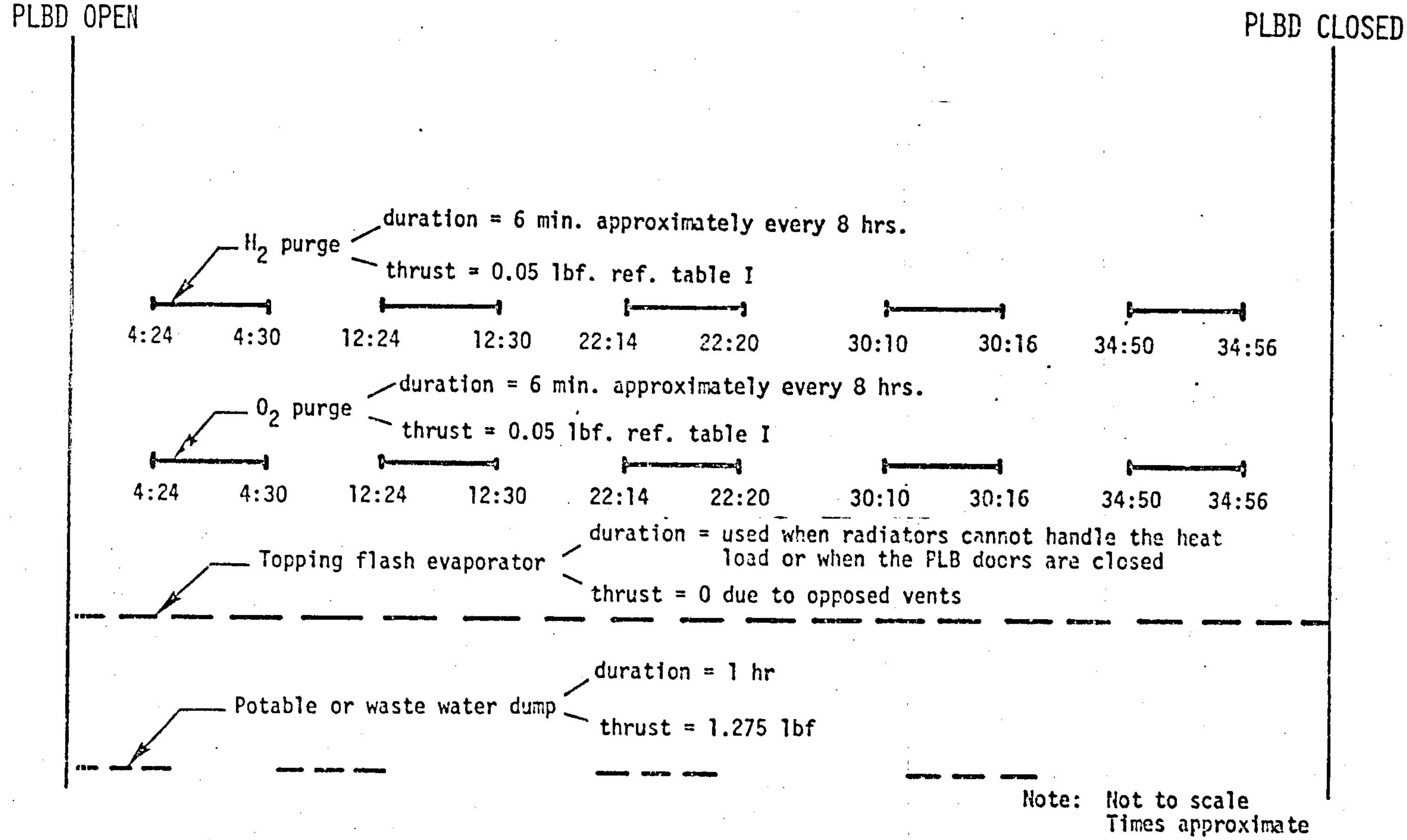
(b) Flight 7-total source power profile.

Figure 8.- Continued.



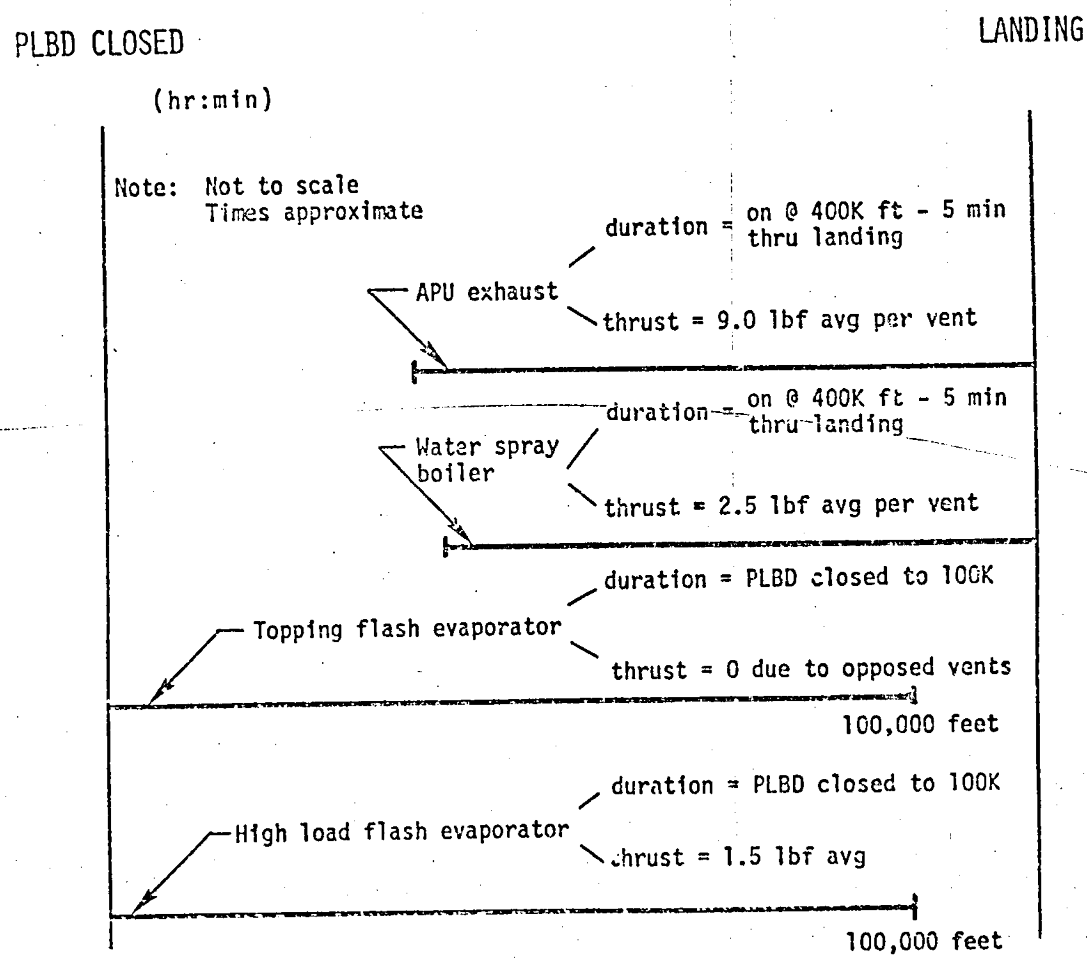
(c) Flight 7 scheduled venting timeline during ascent.

Figure 8.- Continued.



(d) Flight 7 scheduled venting timeline during onorbit.

Figure 8.- Continued.



(e) Flight 7 scheduled venting timeline during deorbit.

Figure 8.- Concluded.

END

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